THE

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RAIL WEAR.

MR. W. THOM, in the *Official Circular* for January of the Tramways and Light Railways Association, has a note on the proportion of rail wear which is due to other causes than the passage of tramcars. He took rails of 87-lb. section, having a useful head wear of $\frac{5}{16}$ in., and by measuring the actual wear on the rails of two sections of tramway in the Potteries district he arrived at the basal figures from which his deductions are made.

On the busier line of the two the full $\frac{5}{16}$ in. had been worn off the rail head or table, during a period of $7\frac{3}{4}$ years, after the passage of $10\frac{1}{2}$ millions of car-tons; while on a line with lighter service, exactly half this wear had taken place during the same period, but after the passage of only one-third of the car-tons.

Mr. Thom points out that on a tonnage basis only, the second rail should have worn down one-third instead of one-half, and he considers that the difference is due to corrosive wear.

His calculation, viewed alone, is convincing :—

Data. (1) 10,600,000 tons in $7\frac{3}{4}$ years wears $\frac{5}{16}$ in., or ·3125 in.
(2) 3,330,000 „ $7\frac{3}{4}$ „ „ $\frac{5}{32}$ in., or ·1562 in.

Assuming that corrosion, &c., is only proportionate to the time, then the wear due to this factor is equal in each of the above cases, and the extra tonnage of 7,270,000 in the first case is solely accountable for the difference in wear shown—viz., $\frac{5}{32}$ in. This shows the wear per 1,000,000 tons to be ·0215 in. Going back to the first case, the wear due to the passage of 10,600,000 tons is thus ·2279 in., leaving ·0846 in. as the result of $7\frac{3}{4}$ years' corrosion, &c., or an average of ·0109 in. per annum.

But it seems to us that one of the most important factors in rail wear has been neglected in this case, although we anticipate that Mr. Thom will be able to explain this apparent omission satisfactorily. It is well known that wear, which in extreme cases is very serious, is caused by the passage of ordinary vehicular traffic, and in the case before us the deductions must be incorrect in some measure unless :—

(*a*) There is no other traffic but tramcars on the rails.

(*b*) Any other traffic is proportional to the car-tonnage over each of the two lines.

Probably both lines are laid in the public roadway, so that (*a*) does not apply.

If we assume, for the sake of illustrating the argument, that the "foreign" tonnage is identical on both routes, we get at once a constant wear-factor which we should be justified in substituting for Mr. Thom's corrosive constant.

We know nothing about the conditions which exist upon the two lines chosen by the author, so that we cannot assume a case with any probability of accuracy.

We look, therefore, to Mr. Thom for guidance, as the subject of rail wear is of great importance, and investigators should be encouraged to probe it to the true root. The association of the various phenomena is so intimate that dissection, even by experienced operators, is a baffling and deceptive process. Witness the corrugation problem, over which so much ingenuity has been spent, with little practical result, if we are willing to accept in proof the reports that tramway after tramway is grinding out the corrugations, and leaving the cure at that.

We would ask Mr. Thom another question, which is of vital importance to the corrosion figures. Is he quite sure that the data for the worn-out rail are sound? This looks such an elementary point that it runs a risk of being called

silly, but it is put more for the purpose of extracting from Mr. Thom the system of measurements by which he was able to conclude his observations at the right moment, than from a desire to prove the figures wrong. There is not a great number of men who are methodical or far-sighted, or patient enough, to carry out over a long series of years a consistent and reliable system of measurements for a definite purpose. If there were, our technical journals would not contain so much argument and assertion based upon conjectural data.

It is evident that Mr. Thom's note is the outcome of well-kept records, or he would not have been able to determine the exact period over which the full wear of $\frac{5}{16}$ in. was going on.

The difficulty which would trip up the all-in-a-hurry investigator is the question—when did the wheel flanges begin to bottom on the rail groove?

If, on account of the compressed dirt which is to be found lying in the grooves of most tramways, the cars running over the heavy traffic section are partly or wholly flange-borne, the head of the rail will have its life prolonged illegitimately with regard to any comparative test against the rails on the less busy route, where the groove is deeper and the cars are tread-borne altogether.

With perfectly clean rail grooves the observer could say with accuracy, in such and such a week or month the rail head on No. 1 route was worn down to the point at which the wheel flanges began to bear on the bottom of the rail groove; while on No. 2 route the rail head, by careful measurement at a sufficient number of points remote from the joints, was worn so much. Then by the aid of the easily ascertained car-tonnage figures he could arrive at his conclusions without fear of criticism.

On the other hand, the dirtier the rail-groove and the more slipshod the observer, the easier it would be to allow the test to continue while full wear was taking place on the rails of No. 2 route, and reduced wear on the rails of No. 1 route.

Merely to put a concrete case, let us assume that the Potteries tests were carried out in this manner; then the ratio $\frac{5}{16}$ in. : $\frac{5}{32}$ in. for wear of rails, which depends upon the critical figures of the calculation, would be too small, for the $\frac{5}{32}$ in. is too large.

Speaking generally, our impression is that the wastage due to corrosion is not so considerable as Mr. Thom thinks, but we should like some one who has two routes of tramway laid with bull-head rail on an open ballasted track to take up the investigation. In that way the foreign traffic and dirty groove difficulties are eliminated, and it would be necessary only to see that the physical characteristics of the routes and the cars running on them were alike in order to get indisputable facts about corrosion. The more unlike are the routes with regard to frequency of service, the more quickly can the comparison be made.

It would not be fair to compare a derelict line with a working line, nor a line on which the service is so small that appreciable rust has time to form on the rail-head with one in which the rail-head is kept burnished by traffic, for other conditions then probably arise, and the constant rolling action of the wheels must affect corrosion compared with the case of rails which simply lie and rot.

Liabilities of an Architect.

A case which was decided last week by Mr. Justice Channell, although it primarily affects architects, is of considerable importance to the engineer whose duty it is to supervise the carrying out of a large contract. How far may the actual work of supervision be delegated to a subordinate? What happened was that certain guardians of a town employed a builder to erect additions to their workhouse infirmary, pursuant to an ordinary building contract. A firm of architects were employed by the corporation in the usual way, it being a term of the contract that a clerk of the works should also be employed. Part of the work consisted in the laying of a considerable quantity of concrete flooring on the ground floor; indeed, it was stated at the trial that the total area to be covered was over an acre in extent. Four years after the whole work was completed, dry rot broke out under the floor, and it was proved that this was due to the work having been improperly done. As there was a clause in the contract which apparently absolved the builder from liability for any defects appearing more than nine months after the work was finished, an action was brought against the architects, alleging that they were responsible for not having supervised the work properly. Their answer was in, in effect, "that was the duty of the clerk of the works. He was acting in collusion with the builder, and he deceived us. We are not responsible." Mr. Justice Channell, who expressed the opinion that the case was a hard one, said he must come to the conclusion that the architects were liable. He pointed out that while matters of detail might be left to the clerk of the works, the proper laying of this flooring could not be regarded as a detail. The architects should have seen that it was properly laid. It will be seen that the court was unable to lay down any definite principle except that above stated. The clerk of the works can only be relied on to look after details. The same principle applies to the engineer. In Saunders *v.* Broadstairs Local Board ("Law affecting Engineers," by W. Valentine Ball, p. 197) engineers who were charged with negligence in laying out and superintending the erection of certain sewers relied on the fact that the defendants had appointed an incompetent clerk of the works. This, however, was held to be no excuse for their negligence. It cannot be too often insisted on that it is dangerous to trust too much to the work of a subordinate.

The International Volt.

On January 1st a new value for the electromotive force of the Weston normal cell was adopted by the Bureau of Standards of the United States—namely, E = 1·01830 international volts at 20° C. It will be remembered that at the International Conference held in London in 1908, new definitions were adopted for the fundamental electrical units, according to which the international volt became defined in terms of the international ohm and ampere; but sufficiently reliable data connecting this with the E.M.F. of a standard cell were not then available to enable the Conference definitely to fix the latter. The value provisionally adopted was 1·0184 International volts, and an International Committee was appointed to complete the work of the Conference; the Committee appointed delegates to carry out an investigation at the Bureau of Standards, which was accomplished last year. The Special Committee recommended the value 1·0183 as being correct within one part in 10,000; the final cipher was added, as in the case of the ohm and ampere, to indicate that this would for the present be regarded as the exact value. By agreement of the International Committee, the various Governments represented have been asked to adopt the new value as from January 1st, 1911.

The uniformity of the Weston normal cell has attained to so high a pitch, as the result of continual improvements, that the value of the international volt may now be derived to an accuracy within two parts in 100,000 from cells set up according to standard specifications, which are not less than one month nor more than one year old, and it is probable that the uncertainty of the silver voltameter is greater than that of the cell. There is, says Mr. S. W. Stratton, director of the Bureau, in the *Official Circular* dated December 31st, 1910, "no likelihood of another change being necessary in the international volt, or of any change being necessary in the international ohm."

The value formerly assigned to the Weston cell was larger than that now adopted; hence the new unit is larger than the old one. Measurements based on the value formerly used in the United States will require a correction of 0·08 per cent. in the case of the ampere and volt, and 0·16 per cent. in the case of the watt.

Telephone Charges.

Under this heading the *Municipal Journal* quotes the recent circular of the P.M.G., stating that the rates to be charged for telephone service after the transfer cannot possibly be settled until the purchase price of the National Telephone Co.'s system has been determined by arbitration, and recalls various statements by Mr. Samuel's predec sso

on which it bases a demand for the prosecution of the agitation started by the Corporation of Glasgow, and for the question to be raised in Parliament at the earliest opportunity. It is quite true, as our contemporary points out, that in 1905 Ministers stated that the question of the future ownership and management of local telephone installations was not prejudiced by the agreement between the Government and the National Telephone Co., and that the Parliament of 1911 would be able to deal with the matter as it thought fit; and there is no objection to the proposed discussion in Parliament, which might, indeed, have very beneficial results.

But the motives which influence our contemporary, and many of the other advocates of a Parliamentary Inquiry, should be appreciated. They are based upon the impression that under municipal ownership and management an efficient telephone service can be given at a low price, and that nationalisation ought necessarily to result in a reduction of the charges—two independent propositions, neither of which can be justified by the facts.

We are not advocates of either municipal or State control of the telephone industry; it is an undertaking essentially demanding technical skill, enterprise and business acumen of the highest order, qualities which cannot be looked for in organisations under popular control, which must take no risks, and must subordinate their knowledge of what ought to be done to their realisation of what they will be permitted by their superiors to do. The Post Office, for example, cannot move without the permission of the Treasury, which again is guided by considerations totally foreign to the interests of the telephone subscribers. But the transfer has been resolved upon, and in all human probability it will duly take place, so that the only question that remains open is whether the State shall own and control the whole of the telephones, and conduct the service on uniform lines, with the best technical and commercial advice obtainable, or whether the municipalities shall possess their own local installations and carry on the business as best they can. How that would be, we know; Glasgow herself affords a conspicuous example of municipal telephony, carried out on obsolete principles and resulting in ignominious transfer to the State at a heavy loss. Now, of all the municipalities in this country, there is none with a better record for capable and sagacious government than that of Glasgow; and where Glasgow failed, what city could hope to succeed? Even if the chief cities conducted their own telephone services, what of the minor communities? They could not possibly hope to provide or manage their own systems, and give low rates on a sound financial basis. Moreover, in telephony, local service is only a part of the system; one of the great advantages of the telephone is that by means of it individuals may converse at pleasure between widely separated towns, and to permit of this convenience, uniformity of apparatus and system is indispensable. Just as competition is incompatible with efficient telephony, so is divided management. To obtain the best results, the whole of the telephones must be installed and controlled on uniform lines and by one authority. Municipal ownership has proved a failure—it is no longer within the realm of practical politics.

As to the charges to be levied, we can sympathise with those who want a reduction; we all do that. But we can hold out no hope that their desire will be gratified. State management, in whatever line of business, is an expensive luxury at the best; generally it is hardly a luxury, but it is always expensive. The Telephone Co., under sentence of deprivation, has had to lay aside large sums to provide for depreciation, obsolescence and amortisation, besides paying heavy royalties to the Post Office; yet we do not anticipate the slightest reduction of charges when the State assumes control. But are the charges heavy now? We fully endorse the statement of the late Postmaster-General to the effect that very many flat-rate users were receiving their service below cost price. Let those who use the service most freely pay in proportion to their user; that is but elementary justice. The only sound principle of charging is that embodied in the measured-rate system, and the universal adoption of that system is not only inevitable, but is fast taking place. Unfortunately, the flat-rate people are precisely those who constitute the bulk of the members of Corporations, Chambers of Commerce, and other public bodies, which are able to make themselves heard and to bring pressure to bear upon the Government. They, who are practically subsidised at the expense of other telephone subscribers, foresee the approaching end of their bounty, and are up in arms, while the vast majority of users, who will be freed by the measured-rate system from the burden of the flat-rate subscribers, are voiceless and unrepresented. Whoever supports the flat-rate system is acting in opposition to the interests of the general public, for the sake of the well-to-do firm or company which profits by the continuance of the inequitable and irrational fixed price for unlimited services.

Post Office Engineers.

There is perhaps no body of men in the engineering profession whose expert work comes so little before the notice of the general public as that of the Post Office engineers; those only who are "in the know" are cognisant of the invaluable and highly scientific work which they have to perform. We believe—indeed, we know—that the Post Office is particularly fortunate in its technical officers, who, if given a free hand, could be depended upon to carry to a successful issue any undertaking that might be entrusted to them. But the trouble is that they are not given a free hand—and never will or can be. That is an inherent defect of popular government. Just as the Army is never placed in the hands of a military expert, or the Exchequer in the hands of a financier, so the Post Office must always be hampered in its work by inexpert control. Unfortunately, it is in the Post Office above all that the layman exercises the most complete authority, and the expert is most severely repressed. As the *Times Engineering Supplement* in an admirable article points out, the Secretary of the Post Office is in supreme authority over the heads of all departments, and the engineering department in particular has long suffered from the arbitrary and uncomprehending attitude of the non-technical officials. The engineer, in the Post office as elsewhere, has no official status; he is underpaid, overborne, and generally treated as a Cinderella. While this state of things endures, mutual irritation and friction are bound to continue, and we cordially endorse the view of the *Times* that there is urgent need for the reform and reorganisation of the whole of the administration of the Post Office, to suit the totally changed conditions of the postal and telegraphic services.

The German Installation Monopoly Question.

A further step to check the attainment of a monopoly by the large firms in installation work and the supply of materials is reported by the German Association of Electrotechnical Special Works, which states that the Imperial Ministry for Alsace-Lorraine, as in the case of some federal governments, has taken action in the matter. The authorities in Alsace-Lorraine, for instance, have been instructed to act in the sense of the order issued last August by the Prussian Government respecting current supply contracts in connection with overland stations. It will be recollected that the order instructed the supervising authorities to take such action, in regard to the construction of overland stations, as to permit of free competition in the establishment of house installations and of the local distributing network, and in the procuring of the materials required for the purpose. It is intended to draw up for the use of combinations of local authorities normal contracts, after the example set in Oldenburg, permanently excluding any monopoly of installation work and materials in Alsace-Lorraine. The same question recently engaged the attention of the Hanau Chamber of Commerce, which made representations on the subject to the Governor of the Government district of Cassel. The Governor in the course of his reply reminds the Chamber of the issue of the Prussian Government order, which he had communicated to his subordinate authorities. He adds, however, that the construction of overhead networks requires specially trained workmen, and if the manufacturing firm undertook the guarantee for the proper carrying out of the network and the regular supply to consumers, it would probably be necessary to leave the overhead lines also to be established by the firm concerned.

D

TEACHING THE ELEMENTARY PRINCIPLES OF ELECTRICITY.

BY P. G.

EXPERIENCE has shown the writer that the easiest way to teach the elementary principles of electricity to the class of student who attends evening classes at trade schools, in such a way that they retain really accurate ideas, is to follow the system of the late Prof. Ayrton.

Starting with the three fundamental properties of a conductor carrying an electric current as the definition of current, and the properties of potential as its definition, the two can be connected very easily, as there seems to be no difficulty in explaining resistance.

The apparatus necessary for showing the properties of the electric current are very simple and always at hand even in the most sparsely equipped classroom, or, if not, can be made at short notice with the expenditure of but a few pence, and do not need description.

The properties of potential are generally given in connection with frictional electricity, and with this foundation, muddle usually results. The following experiments were devised to overcome the difficulty experienced in removing the idea that there was something different about frictional electricity, and to provide a convenient step from current to potential.

A circuit is arranged as shown diagrammatically in fig. 1. The two small brass balls *b b* are arranged about three-eighths of an inch apart, with a small pith ball *d*, blackleaded to make it conducting, suspended on about 6 in. of silk *e* between them, the space on each side of the pith ball being $\frac{1}{16}$ in. wide. A piece of wire *c*, easily removable, joins the two balls. The circuit consists of a lamp *f*, ammeter *a*, voltameter *g*, and this potential indicator. A 200-volt D.C. supply is quite suitable, and it can be arranged to work on a 100-volt circuit, but this is a little difficult.

So long as the wire joins the two balls, the current flows and is clearly indicated by all the instruments in the circuit. As soon as the current is stopped flowing by removing the wire joining the brass balls of the potential indicator, the small pith ball starts swinging between them and continues oscillating as long as the potential remains. The power of attraction and repulsion is thus clearly shown, and can be demonstrated on a larger scale with a glass rod, a Wimshurst or other machine. The use of a gold-leaf electroscope to indicate potential easily follows.

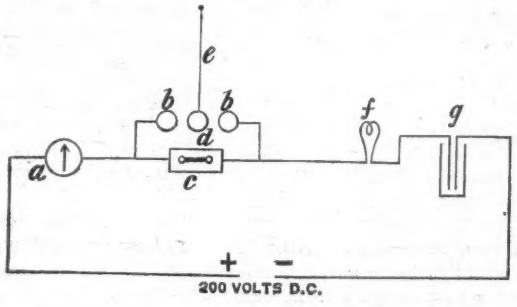


FIG. 1.

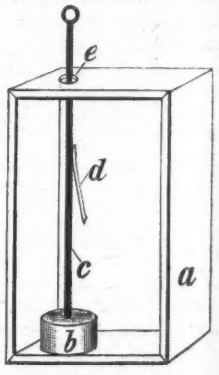


FIG. 2

To show the fall in potential along a conductor, a sensitive electroscope is necessary. This can be constructed as follows, and will be found more convenient, better insulated and generally more useful than the more elaborate ones sold by instrument makers.

To one side (on the inside) of a cardboard box with a glass front (obtainable for a few pence), a small block of sulphur *b* is fixed, carrying a copper wire *c* projecting through a clearing hole *e* at the top of the box. A piece of silver leaf *d* $\frac{3}{4}$ in. × $\frac{1}{16}$ in. is stuck by one end to the wire. This will give a deflection of about 30° for 200 volts potential difference between the leaf and the box, and will only drop a little if left 12 hours. The cardboard is sufficiently conducting to form a good "earth."

The generator of an Evershed testing set is usually available, and forms a very suitable source of 500 volts D.C. pressure. The circuit can be made with a piece of string about 3 yards long supported on insulators, the ends being connected to the terminals of the generator.

If one pole of the dynamo is connected to the table or held in the hand, and the electroscope is held to the other end of the circuit, a full deflection is obtained, which drops as it is brought round the circuit to the earthed terminal. On connecting the other pole to the table, the reverse effect is seen, and clearly shows the meaning of "earth" potential.

If a sensitive galvanometer is introduced into this circuit, the flow of current can be shown at the same time.

These simple experiments may not be novel, but they have been found very effective in producing that clear idea of elementary principles so essential to all engaged in the electrical industries.

WANTED: ELECTRICAL COOKING APPARATUS ON HIRE.

BY INTERESTED.

MONEY awaits the enterprising man who is first to inaugurate a regular business in the way of hiring out first-class goods of this description on a large scale at reasonable terms. In any town worthy of the name there exists to-day a big demand for good electric cooking ranges, and also for some form of electric water heater capable of giving a continuous supply of hot water throughout the day. I will not endorse the remarks which at one time appeared on the back of invoices for energy sent out from the accountants' office of a certain metropolitan borough reading something like this, "The apparatus is readily movable, and can be used without smoke, flame, dirt or noise." Applied to gas ranges there might be some justification for those words, "smoke, flame, dirt and noise," but referring to electric heating and cooking utensils it was, to say the least, a wee bit out of place. A few remarks regarding the advantages claimed for electricity used in this manner would have been far more appropriate and more in keeping with modern business. But that is straying from my path. The point I want to emphasise is that a real live demand exists at the present moment for electric water heaters, cookers, hot plates, &c. Consumers are frequently inquiring after such. The idea of a nice clean, neat range with hot water always available, and the whole easily operated by means of one or two small switches, appeals to many. No matter what size the installation, large or small, whether put in by landlord or tenant, the idea is the same; people do want to use electricity for cooking and general domestic purposes if possible, and it is chiefly the present high prices of the utensils themselves that prevent electricity being more extensively used for this purpose. Once get over that large outlay of first cost, and three-parts of the difficulty now standing in the way of "electricity for domestic purposes" is at once removed.

Inquiries after this form of goods are constantly being made by prospective customers at the supply works offices, but when some price lists are produced—well, that soon settles the question, and nearly always has the effect of choking off the man of moderate means, and frequently those who are plentifully supplied with this world's goods also. Some make use of that handy phrase, "I will *wait and see*."

There are some good stoves and heaters now on the market, but really serviceable goods economical in their consumption of current are few and far between. Some articles of this nature are all right in themselves and do what is claimed for them, only in their consumption of current they are a long,

long way from being satisfactory. Special facilities are required in order to induce a more extensive use of electricity for general domestic purposes. These facilities are sure to be slow in coming along until the demand for cheap power rates in the daytime becomes apparent to the supply authorities, and the heavy initial cost of the utensils is alone responsible for preventing the demand from forcing itself into notice immediately. Given the apparatus in a house, much like the present day ranges using coal and gas, the demand is at once apparent. In keeping with that old saying, "necessity is the mother of invention," cheap charges for electricity would be invented directly the apparatus was installed waiting for reasonable power rates.

Consumers do not object to pay a fixed sum per quarter, or per annum, for the use of a good, serviceable cooking installation, although they will not think of paying away a large sum to purchase the goods outright, and all the talking, writing and advertising in the world will not alter matters in this respect. Directly someone introduces electric cooking ranges in private houses and includes the hire charge as part of the rent, say, then there will be plenty of customers for him, and a capital advertisement to help him let his property.

What is to prevent some business men from forming a company for the sole purpose of hiring out cookers, stoves, water heaters, radiators, &c.? That should prove a profitable undertaking. The capital required would not necessarily be great, because once a quantity of plant were out on hire and the business were on a sound footing, more money could very well be obtained from a bank on security of the plant already installed in customers' houses, and so the business would grow with a nominal amount of capital. Stock would be almost as good as money to the concern. Of course the firm must see that cheap current is available. Immediately they are in a position to approach the supply authorities and say:—"Here, we have so many houses fitted up with cookers and heaters waiting for cheap electricity" the supply people would see a vision of the much-sought-after day load, and offer reasonable terms accordingly. This is a matter for private enterprise, not municipal. A firm having no direct interest in the sale of current would be in a far better position to secure for prospective customers cheap power rates than would be the case where the supply authority took up the business as a side line for themselves, because those responsible for the sale of current might fancy their own interests regarding the sale of electricity of more importance than the side line, and the cooking utensils, &c., would have to take second place. There is not much doubt that a private company would do better than a municipal shop, and past experience seems to confirm this view. Imagine a company going to a supply works and making an offer to take a stated constant load throughout the hours of daylight, say, for about 30 houses, providing always that suitable terms could be arranged, and promising as many more if the figure were low enough to warrant the business; why the supply man should welcome the demand with open arms. But if the offer were made, would it be welcome under present-day circumstances?

The important point to bear in mind is the necessity for a constant demand in order to enable customers to obtain cheap current. A station can far better afford to take a low figure for small continuous loads, then a fairly moderate one for demands which come on for a short time, and then remain idle for hours. A supply undertaking cannot really afford to sell current profitably, even at 1½d. and 1d. per unit for the intermittent load now demanded by many forms of cooking and heating apparatus. If a true record could be obtained, I doubt very much whether the average length of time such utensils are actually consuming electricity would work out at more than one hour per day, perhaps less. Unlike gas, electricity cannot be stored to advantage in large quantities ready for supplying fluctuating loads, and probably the only system on the market at present demanding a small current over long periods is the Therol system of heating and cooking. With these devices there is a constant demand for, say, at least 12 hours per day, and any works should be able to offer terms for a continual supply of this description low enough to bring electricity much more in evidence for domestic purposes than is the case just now.

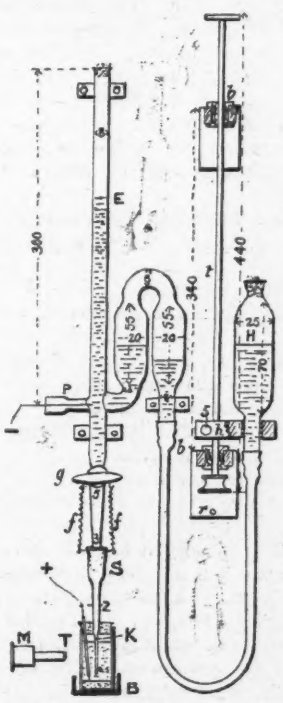
Generally surveying in one's mind the various forms of goods being advertised in both this and other countries, the Therol system seems to stand out alone. No other form (to my knowledge) uses anything like the same principle—*i.e.*, takes a small current constantly, and stores the heat obtained from a small heating element of low consumption in a manner which enables a reserve to be formed ready for any sudden call upon the apparatus. "We can create a day load for you"—that is what the Therol people might justly say to the supply authority. Providing these heaters, cookers, &c., do all that is claimed by those interested in the sale of them, there is, without a doubt, a big future before them, especially if some arrangements could be made to hire out the goods or sell them on the hire-purchase system.

A NEW PATTERN OF CAPILLARY ELECTROMETER.*

By L. ZEHNDER.

The capillary electrometer only gives good results when the capillary is more or less new and the mercury as clean as possible. The position of the mercury meniscus should also remain practically constant. In order to satisfy these conditions more completely than in previous types, the author has given to the capillary electrometer the design shown in the figure below.

The pressure apparatus is shown on the right of the illustration. This works on the principle of Jolly's air thermometer, such a pressure being exerted on the mercury column



Capillary Electrometer.

situated above the capillary that the mercury meniscus in K remains constant in position whether an E.M.F. is applied to the electrometer or not. The mercury of this pressure apparatus should not be allowed to flow into the mercury of the electrometer, owing to its being in contact with a length of rubber tubing. Accordingly, the quantity of mercury to be poured into the electrometer and the air to be contained

* Abstracted from *Zeitschrift für Instrumentenkunde*, September 1910.

in the double vessel should be approximately calculated. The vessel H containing the mercury supply, is attached to a holder *h*, which can slide with gentle friction up and down the rod *t*. Large pressure changes can be produced by sliding the holder *h* on the rod *t*, and small pressure-changes are brought about by turning the milled screw head *r*; it is thus possible to accurately adjust the mercury-level in the electrometer. A mirror and scale enable the height of the capillary meniscus to be accurately read.

The tube E (about 8 mm. internal diameter—the internal diameters of the tube are figures on sketch) has a platinum wire at P fused in at the level where the double vessel adjoins it; and, lower down, an ungreased glass stopcock *g* by means of which the capillary can be shut off from the electrometer. The glass tap is quite mercury-tight. Underneath this stopcock is an ungreased stopper S which passes into a piece of tube 2 mm. internal diameter; the lower part of this tube is constricted into a capillary of 0·5 mm. The two parts of the ground joint must also be rendered mercury-tight and are held together by steel springs *f*, *f*.

Detailed instructions are given for making the capillary, but to repeat them here would occupy too much space.

In order to fill the electrometer, the vessel H is first placed at the same level as the double vessel and pure mercury is poured in until the vessel H and the right half of the double vessel are half full. After closing the stopcock *g* pure mercury is poured into E, during which operation care should be taken that the mercury goes far enough into the small tube supports at P, to form contact with the projecting end of the platinum wire. Sufficient mercury must be introduced into E so that when H is raised, the mercury in E occupies its highest position in the tube. If there be too much air in the double vessel it escapes through E when H is raised. The joint S with the capillary inclined as much as possible is carefully filled to the widened part with pure mercury in such manner that no air-bubbles are enclosed between the mercury columns in the 0·5 mm. capillary and the 2 mm. tube. The ground joint is then put together, the steel springs *f*, *f* introduced and the stopcock *g* opened. The mercury flows through the stopcock and forces out the air contained between the stopcock and joint, either through the capillary spaces of the stopcock or through the joint. If, however, an air-bubble should remain to disturb the continuity of the mercury column, it can easily be removed by slightly loosening the joint and letting out some of the mercury.

The sulphuric acid vessel used by the author is an acid-proof trough T, composed of plane parallel walls and rectangular in section. Some mercury is placed in the trough, and above this accumulator acid. A platinum wire contained in a fine glass tube is inserted in the trough, the latter being placed in a lead bath B. When the mercury flows from the capillary, the trough is raised until the capillary plunges into the acid; H is then lowered to prevent the further escape of mercury. The trough T should be at such a height that its upper edge is on a level with the 2 mm. bent tube underneath the joint mentioned. It rests on a small bracket fixed on the back wall of the electrometer, and can be raised and lowered in slots. When in use, H and E are closed with plugs of cotton wool. The vessel H is adjusted in such a manner that the mercury meniscus in the capillary is seen on a suitable division of the micrometer eye-piece M. The mercury level in E is read off. The potential difference is now applied to the terminals of the platinum wires. The mercury ought then suddenly to find its new position of equilibrium. The vessel H is then raised, as above described, until the mercury in the capillary rests on exactly the same division as before, and the mercury level in E is again read. After the scale for the tube E has previously been calibrated with known potential differences, the potential differences sought are calculated from measured positions of the mercury column.

If the sensitiveness of the capillary electrometer is not of the value desired, the vessel H is either raised or lowered and measurements taken at another place on the capillary, which is always more or less conical in shape when drawn out. Its narrower parts are generally more sensitive than the wider ones; the meniscus is also more displaced by small potential or pressure changes the more the cone of the capillary approaches a cylindrical surface.—E. S. Hodgson.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment No letter can be published unless we have the writer's name and address in our possession.*

Electricity in Mines.

I feel that all competent electricians would welcome some scheme of registration, also a qualifying examination, as suggested by your correspondent "Pro Bono Publico." There is also another point which, I think, the Home Office should fix, that is, the wages to be paid, for it is certain that employers will not get the best men to take the risks (for, no doubt, there are risks) unless they pay them accordingly.

There is a great necessity for the best men in mines, but I am sorry to say that the men that I have met are chiefly rule-of-thumb men, and men with technical qualifications are not altogether loved; I am not of the opinion that it is necessary for haulage men to be sound technical men (as your last week's correspondent would have) any more than it is necessary for a tram-car driver to be a B.Sc. But it is necessary for men erecting plant, mains, &c., to know the why and wherefore of the case.

Mining Electrician.

Trading Methods: a Criticism.

It is painfully evident to-day that the manufacturer is losing—in fact, has lost—the power and ability to negotiate for the successful sales of his manufactures, and the methods he now employs leave him without a vestige of self-respect, or the possibility of creating the esteem of the purchaser; and who would hesitate to say that the fault is any but his own.

It is a generally accepted fact that it is easy to give things away, but the decrepit methods now prevailing have made even this a matter of considerable difficulty. Let us see why this unfortunate state of affairs exists.

The average outsider would consider that the electrical profession consisted of gentlemen of intelligence, capable of sound judgment and shrewd insight into the possible requirements of their clients or consumers, which would enable them to place before the latter in a way sure to secure profitable sales, many of the work-saving comfort-producing appliances that the manufacturer has, in his saner moments, been able to produce. It would be useless to expect anything of the smaller contractor; the majority of these so-called electrical engineers will, one hopes, soon disappear from the field of operations altogether, for they make no attempt to pay their way, nor in any way do they do what is best or necessary for the credit of their profession, or even to the ultimate good of their business.

But, passing on to the larger public concerns or wealthy supply companies, and the higher rank of electrical engineers, a few of whom we still have with us, we can see at once that the weak policy and pitiful plight of the manufacturer are fast bringing them down to his own level—a quite unnecessary lowering of business integrity—until at last, in a vain effort to save a deeper precipitation in the manufacturer's efforts to give his goods away, we see a lengthy decree issued, when the depraved representative of the manufacturer implores in an undertone a junior member of a contracting firm or generating station staff to accept from him this "something for nothing," which may range from a showboard to the latest and most up-to-date "no-servant-required appliance." Out of pity alone, the unwilling beneficiary accepts the gift upon the condition that the manufacturer signs a nine-clause legal-looking document, of sufficient interest generally to be mentioned here :—

1. That the company shall reserve the right to determine the number of fittings, motors, heating and or other apparatus, being the property of the manufacturer, to be exhibited in the showroom.
2. That the company shall not be held responsible for any deterioration in the value of the fittings, motors, heating and or other apparatus, resulting from the settlement of dust, tarnishing of lacquer or otherwise.
3. That the company shall reserve the right to allow other manufacturers to exhibit fittings, motors, heating and or other apparatus in the showroom.
4. That the company shall indemnify the manufacturer against

any loss through damage to the fittings, motors, heating and or other apparatus by fire, burglary or accident.

5. That each fitting, motor, heating and or other apparatus submitted by the manufacturer for exhibition in the showroom shall have a label attached stating the name of the manufacturer and price of goods.

6. That the manufacturer shall have the right to remove any fittings, motors, heating and or other apparatus exhibited by him or them which he or they may urgently need owing to depletion of stock, provided he or they replace same at the earliest possible moment.

7. That the company shall refer prospective purchasers of the manufacturers' fittings, motors, heating and or other apparatus to the manufacturer, at the same time notifying him or them of the catalogue number of each fitting, motor, heating, and or other apparatus.

8. That the manufacturer shall upon receiving payment from the purchaser for any fittings, motors, heating and or other apparatus so ordered undertake to deliver the same from his or their stock to any address. The company will not accept any responsibility for the payment of accounts for fittings, motors, heating and or other apparatus supplied to the purchaser.

9. That this arrangement may be terminated by either party giving to the other one month's notice in writing.

There is possibly time for the manufacturers to save themselves the inevitable result of this downward drifting, and it is to be fervently hoped that an effort will be immediately made—remembering that they manufacture to sell. What have they to say?

Peter Doody.

Two Advertisements.

There were two advertisements in one of your recent issues which I wish I could have republished in every newspaper in the United Kingdom, in order that they could be printed together, compared, and brought to the notice of every parent in the country who may have any idea that electrical engineering would be a good thing for his or her sons to go in for.

From what I know, I believe that 19 out of every 20 who have trained themselves at heavy expense for the work (it is absurd to call it a profession, as there is no standard of training or qualifications laid down by the Institution of Electrical Engineers, nor is there a Board of Trade certificate required) do at the present time rue the day they ever thought of electrical engineering as an occupation in which they would surely be able to get a decent living, and increase of pay, if nothing else, for continued years of faithful service. Every electrical engineer in the country will know what I mean, and I therefore do not wish to belabour the subject in this letter.

Such advertisements speak volumes to the many who know all about council or corporation appointments, and who gets them as a rule—the premium pupil, whose parents have spent the savings of their lives in premiums to get their son properly qualified for a post, or the youth who does not pay any premium but gets paid in wages for learning the work.

I consider that the system of council authorities taking premiums from pupils, or allowing their chief engineers to take them in augmentation of their salaries, is as mean as it is unprincipled, when it is taken into account that in some cases it is the nominee of a councillor or an applicant who is a friend of the chief engineer who gets appointed to any decent salaried post, and most likely a man who got wages paid to him for learning all about electricity and electrical engineering from those who had to pay for their training.

One of the advertisements related to a vacancy for a pupil at a premium of fifty guineas a year, and the other was for a qualified shift engineer at a wage of 25s. a week.

Here is the chief engineer at one borough electricity works requiring a premium of fifty guineas a year from a pupil, and the chief at another station advertising for a qualified shift engineer at a wage of 25s. a week.

I blame the chief engineers more than I do "sweater" Councils, for it is only two well known that in certain cases they employ engineers (misnamed as such) at 10s. a week, and get credit to themselves for being "economical" managers.

In the suburb of London where I live, the street sweepers are paid 26s. a week for six days a week.

Twenty-five shillings a week for a qualified electrical engineer, inclusive of Sunday labour!

B. Brownrobert.

January 24th, 1911.

[We have found it necessary to omit certain parts of our correspondent's letter.—Eds. E.R.]

LEGAL.

Griffin *v.* L.C.C.—Tramcar Accident Claim.

John Griffin, living at Poplar, and employed as yardman at West's brewery, Hackney, sued in the King's Bench Division, before Mr. Justice A. T. Lawrence and a common jury, to recover damages for personal injuries sustained, it was alleged, by the negligence of a conductor of one of the London County Council's electric tramcars. The plaintiff, it appeared, according to his case, boarded the car on the evening of January 14th of last year in the Commercial Road, Whitechapel, and while standing on the platform deciding whether he should ride on the top or inside, others got on to the car, while some were coming down from the roof. As a consequence the platform became crowded, and the conductor coming down from the top pushed the plaintiff, who fell into the road. The car was in motion at the time, and as a result he received serious injuries to the head and arm, which incapacitated him for several weeks. The injuries to the head were such that he would, it was said, be permanently mentally affected. The case for the defence was that the conductor found it necessary to remove the plaintiff from the car owing to abusive language, and it was during the removal that he fell and was injured. The jury found for the defendants.

Pratt *v.* London United Tramways, Ltd.

On Friday, January 27th, this case was heard in the King's Bench Division, before Mr. Justice Pickford and a common jury. Mr. Geo. Percy Pratt, an architect and surveyor carrying on business at Acton, and living at Homefield, Wembley, sued the defendant company claiming damages for injuries caused to him by the alleged neglect of defendants' servants. Plaintiff's case was that on November 3rd, 1909, about 11 a.m., he was cycling in the Uxbridge Road, when he was caught by an obstruction in the road caused by the defective laying of the defendants' tramway, and was thrown from his machine, and, being struck by one of the defendants' trams, he suffered severe injuries. The defendants denied any negligence, and said the accident was caused by the plaintiff's own negligence in trying to pass between two trams travelling in opposite directions at a time when he ought to have known it was dangerous. Mr. E. H. Coumbe appeared for plaintiff, and Mr. Roskill, K.C., and Mr. W. C. Henderson for the defendant company. The jury found for the plaintiff, with £50 damages. Judgment accordingly.

Skidmore *v.* L.C.C.

On Thursday last week in the King's Bench Division, before Mr. Justice Bray and a common jury, this case was heard. The plaintiff was a boy of 17, and he claimed damages for injuries caused by the alleged neglect of defendants' servants while driving an electric tram near Bedford Row, by which plaintiff was injured by the vehicle. The accident took place in October, 1909, and the plaintiff's thigh was broken. The defence was that the plaintiff slipped on the metals while crossing the road, and fell against the tram. Mr. Eric Dunbar appeared for the plaintiff, and Mr. Pike Glasgow for the defendants. After hearing the evidence, the jury found for the defendants, and judgment was given accordingly.

London Electric Supply Corporation, Ltd., *v.* Westminster Electric Supply Corporation, Ltd

In the Chancery Division on January 28th, Mr. Justice Joyce had again before him a motion to restrain defendants (as alleged) soliciting or attempting to entice away plaintiffs' customers in breach of defendants' obligations under an agreement with the plaintiffs.

Mr. Gore Browne, K.C., and Mr. Cartmel appeared for plaintiffs, and Mr. Younger, K.C., and Mr. Kennedy for the defendants.

Mr. Gore Browne stated that the plaintiffs had got the right to supply electrical energy for a considerable portion of London, including part of the City of Westminster. The defendants had powers under Provisional Orders and Acts of Parliament to supply Westminster so that they overlapped and supplied customers in the same area. The plaintiffs had always been in the habit of supplying alternating current, and the defendants continuous current.

Mr. Younger: Each company was authorised to supply both but did not do so in fact.

Mr. Gore Browne said that until recently the alternating current supplied by plaintiffs was not nearly so suitable for power as the continuous current, but recently devices and machinery had been invented, making it practically equally satisfactory to work machinery by alternating as by contiuuous current. The plaintiffs appointed the defendants managers of this part of their business, and having got control they took advantage of this to get away that business from the plaintiffs, they being competitors in trade. The effect was that they would have a monopoly, and be able to charge what price they like to the public.

Mr. Younger: We deny all this altogether.

Mr. Justice Joyce: It will have to be tried?

Mr. Gore Browne said he was willing for the matter to stand until the trial of the action if his friend would give an undertaking meanwhile.

Mr. Younger: No; I cannot give any undertaking.

Mr. Justice Joyce: It may be very serious in the interval?

Mr. Gore Browne: Certainly. If my friend will not give an undertaking I must go on.

Mr. Younger said it would be a long and complicated business. He could not give an undertaking, but he would agree to a speedy trial. This complaint had been going on since September last. His case was that the defendants were doing no wrong.

Mr. Justice Joyce: Are you both ready for trial?

Mr. Gore Browne: Yes.

His Lordship said he would fix Wednesday, February 15th, for the trial of the action, subject to any part-heard case. There would be no order on this motion, except that the costs be costs in the action.

Mr. Gore Browne: In the meantime, my friend will not solicit my customers.

Mr. Younger: No, I cannot give any undertaking. Counsel explained that the defendants supplied both power and light. They had been compelled, by reason of a falling-off in the demand, to quote higher terms to persons who only took power, than to those who took both power and light. They had sent out circulars stating the terms upon which they were prepared to supply power, and it was impossible to say how many applications might be received during the next fortnight for power on the terms quoted.

After some further discussion, Mr. Younger undertook not to send out any further circulars pending the trial, it being agreed that the defendants should not be precluded from accepting applications made on circulars already issued.

Mine Employe Prosecuted.

At the Manchester County Police Court on Thursday, January 26th, Benjamin Benyon, a collier, of Irlams-o'-th'-Height, was summoned for a breach of two special rules of the Coal Mines Regulation Act. It was alleged that he, an unauthorised person, interfered with an electrical appliance and took part in shot-firing, thus endangering his own life, in the Agecroft pits of Messrs. Andrew Knowles and Sons, Ltd. The case arose out of the recent prosecution of another collier named Isaac Pollitt, of Manchester Road, Irlams-o'-th'-Height, who was fined for a breach of the Act with regard to the use of the electrical shot-firing apparatus. It was stated that Pollitt asked Benyon to fasten the electric cable to the charge, and that when he did so Benyon was injured by an explosion. It was added that Benyon had been in contact with the explosive known as Exellite, which contained, among other things, nitroglycerine. A fine of 1s. and costs was imposed on Benyon for meddling with the apparatus, and the other summons was withdrawn.

Musto *v.* Grevener.

In the Shoreditch County Court, recently, before his Honour Judge Bray, Mr. Geo. Musto, of Upper Norwood, a hairdresser, sued Messrs. J. & H. Grevener, electrical engineers, to recover £13 7s. 6d., being the amount paid for the hire of an electric motor, the cost of putting another one in, and damages sustained for the period that the defendants' motor could not be worked. The defendants counter-claimed for £9 13s. 3d., the balance of the hiring due. Mr. H. N. Bryant appeared for the plaintiff, and Mr. J. E. Walker for the defendants. Mr. Bryant said the grounds of the claim were that the periodicity of the motor supplied was not suitable for the electric supply of the Croydon Corporation. The plaintiff desired an electric motor to run a rotary machine hair-brush. There were the two kinds—the superior, which revolved by itself when the switch was turned on, and the other, which had a mechanical contrivance to start it, usually called the fast and loose pulley. Plaintiff wanted one to start at once. When the motor was ordered, Mr. Ingold, of the defendants, was told that the pressure was 200 volts, alternating current, 60 periods. He submitted that the motor must be suitable for the supply periodicity, and it could not be worked properly if a 50-period machine was supplied, such as was done. Mr. Musto, the plaintiff, gave evidence as to giving the order for a ½-H.P. motor to run the shafting, he at the time telling Mr. Ingold of the current. When supplied he found it would not start the shafting, so he applied to Messrs. R. Hovenden & Sons, Ltd., of City Road, to supply another motor, and they did so. The shafting was not taken down or altered; they put in another motor, and there had been no difficulty with it since, it having worked like a charm.

Walter Larner, an electrician, of 12, Weston Street, said he put in all the electric fittings for the shop. He did not think that a 50-period motor would be of any use with a 60-period circuit. Similar evidence was given by Mr. James Willetts, of 19, Gray's Inn Road, an electrical engineer, who admitted that he did not know what a starting torque was.

For the defence, Mr. Ingold was called, who said that at the time of the order he was in the employ of the defendants. In all about 25 motors of a similar character had been fitted in the Croydon area. The makers standardised between the 40 and 50-period motor, and he did not think there was a maker in England who made a 60-period motor. He thought it required a fast and loose pulley at the plaintiff's.

Mr. Dunlow, an electrician in the employ of the defendants, said they supplied a large quantity of these single-phase motors. If a 60 period was ordered it was usual to supply a 50-period machine. He saw the shafting and it was clearly out of alignment, although he admitted that the friction could not be got correct.

Mr. Henry Jas. Booker, an electrical engineer employed by defendants, said the starting torque in these motors was always small, and therefore they recommended in their catalogue that a buyer should have a fast and loose pulley. A more expensive machine could of course have been supplied to do the work.

Judge Bray said he was satisfied the plaintiff gave an order for a ½-H.P. motor, and he relied upon the defendants to supply such an one as would drive his shafting without giving it a mechanical start. He was not told a fast and loose pulley was necessary, and it was reasonable for him to think it was not. The motor had been returned to the defendants, so he would award the plaintiff £7 and costs.

Sir John Benn's Appeal.

On Monday, in the Court of Appeal, before Lords Justices Vaughan-Williams, Farwell, and Kennedy, Mr. Bromley Eames made an application in the case of Griffiths and Another *v.* Benn, which was an action for libel brought by the patentees of the "G.B." system against Sir John Benn, and which resulted in a verdict and judgment for the plaintiffs with £12,000 damages. Council stated that the plaintiffs had agreed to the defendant, who desired to appeal, paying into court £250 as security for the costs of the appeal, but the officials at the Pay Office had declined to accept that sum without an order of the Court. He, therefore, asked for an order. Their Lordships made the order asked for.

REVIEWS.

Practical Wireless Slide Rule. By Dr. H. R. Belcher-Hickman. London: *Electrician* Printing and Publishing Co. Price 2s. 6d.

This little cardboard slide rule should prove useful to engineers and investigators who may be frequently called upon to compute the oscillation constants or wave lengths of wireless telegraph apparatus. It is arranged in a convenient size and form for the breast pocket. The upper scale of the rule gives wave lengths in metres and feet, the corresponding vibration frequencies being also indicated. As the scales are arranged to show wave lengths from 100 up to 10,000 metres, it will be seen that the requirements for practical work are well covered. The lower scale on the slide shows the dimensions of the corresponding capacity in hundreds of centimetres and in hundreds of micro-microfarads, while the lower fixed scale on the rule gives inductance values in tens of microhenries. It is a little unfortunate that such confusing units have to be taken for the capacity and inductance readings, but this is due to the necessity for keeping suitable figures on the scale itself. A little practice will, however, enable the user to overcome the initial difficulties, whilst he will be relieved of the cumbrous calculations necessary in the absence of a rule.

Steam Turbines: Their Design and Construction. By Rankin Kennedy. London: Whittaker & Co. Price 4s. 6d. net.

This book contains 101 pages, including 62 illustrations. In the preface we read that "this small work is designed for the use of Engineers and Students who desire to obtain an insight into the methods whereby the principal dimensions of Steam Turbines are calculated, referring to first principles." The sentence seems awkwardly worded, and the capitals are superfluous, but the meaning of the author is fairly obvious. We really think that the book is more suitable to students than engineers engaged in practice, because there are several points which need the further explanation of the demonstrator. This is especially the case in the first chapter, to which the title given is "theoretical, mechanical, and physical problems." Twenty-four pages are inadequate, unless, as

we suspect, the author's idea is a revision of the students' lectures. The next chapter deals with elementary turbines, and different types of turbines. In Chapter 3 there is a discussion of turbine wheels in series. In this chapter some data are given concerning the cruisers *Amethyst* and *Topaze*, which are surely somewhat ancient, and occupy space which could well have been used to greater advantage. Chapter 4 gives us a description of some steam turbines, and hints on calculating the principal dimensions. The next and last chapter is on the construction of turbine wheels. The book is a curious admixture of the theory and practice of the steam turbine, and at times the text seems very jerky. Most of the illustrations are good, and there are certainly some excellent features—especially the numerical examples—in the letterpress. Yet it must be confessed that the net result is disappointing. There are a very large number of symbols used. Of course, it may reasonably be stated that these things are essential to a book on design. But what we wonder is whether the student will not find some of the formulæ irritating, and some of the "talky-talky" diffuse. We cannot honestly recommend the student to buy—unless he can afford to indulge in the luxury of more than one book on the subject. It is a good supplement to other volumes. And, like the curate's egg, "It is very good in parts."

Wireless Telephones. By J. Erskine-Murray, D.Sc. London: Crosby Lockwood & Son. Price 1s. 6d.

This is a popular work in nine chapters and a brief glossary of electrical terms used. It is written in a style suited for the lay reader, who will be satisfied with a brief outline of the leading principles involved. The book contains nothing of special engineering or technical interest, mainly, of course, for the reason that the author admittedly does not attempt to probe far into the subject nor to enter into any examination of the details of the several methods referred to. A sanguine view of the future of wireless telephony is taken which will probably prove attractive to the lay reader, but will hardly deceive the practical telegraph and telephone engineer.

Téléphonie. Du Téléphone Bell aux Multiples Àutomatiques. By Albert Turpain. Paris: Gauthier-Villars. Price 5 fr.

This work of 175 pages is mainly descriptive, and covers types of apparatus, methods and systems, together with a brief history of the development of the telephone receiver and microphone. A special feature of the work is the description of exchanges with automatic multiples as developed and used in the United States, the French system of Lorimer and semi-automatic methods. The Pupin loading system is briefly referred to in a chapter on telephone cables and long-distance telephony, but the information given is extremely scant in this respect in view of its importance. The book does not touch the practical engineering side of telephony, but will be of interest to students who desire a descriptive account of modern systems and the general trend of development in the subject.

Handbuch der Telephonie. By Dr. Victor Wietlisbach. Leipzig: A. Hartleben. Price M. 12. Second edition, revised and enlarged.

The first edition of this work was prepared by Dr. Robert Weber from the manuscript of the late Dr. Victor Wietlisbach. In the second edition, now before us, the amount of matter has been increased by about one-half, and the value of the work considerably enhanced by the additions, which are from the pen of Ingenieur Johannes Zacharias, who explains that he has taken the matter up through the illness of Dr. Weber. It is claimed that the work is now the most complete and searching of any publication on the same subject. There are nine chapters, including appendices, covering some 468 pages and 446 illustrations. Historical matter is but very briefly touched upon, while both the physics of the subject and methods of practical telephone engineering are fully discussed. Automatic switching systems, however, are not made a feature of this treatise. Several of the better known systems are referred to, but the author excuses himself from doing more than briefly summarising the *modus operandi* involved, and pointing out the more serious drawbacks entailed in the systems as they exist at present, on the plea of undue enlargement of the work and the numerous and complex drawings required for their full elucidation. References are given to papers and treatises where full particulars can be found. The semi-automatic system of Dr. Steidle, however, is fully described. Part of the book is devoted to a very useful account of engineering methods involved in the construction of telephone lines and laying of cables, together with details of the appliances used in carrying out these undertakings. Much useful engineering data is likewise given, and a short chapter is devoted to the subject of wireless telephony.

On the whole, there can be no doubt that the work is one of value to telephone engineers, and a perusal goes far to confirm the claim made that it is, perhaps, the most comprehensive and complete treatise yet published on this important subject. The book is bound in a pleasing, compact and durable manner.

Notions Fondamentales sur la Télégraphie. By Albert Turpain. Paris: Gauthier-Villars. Price 5 fr.

This is a work in three parts, containing 12 chapters and some 172 pages of matter. Part I relates to simple telegraph systems and the theory of telegraph transmission; Part II is devoted to systems of high-speed telegraphy, and embraces full descriptions of the Wheatstone, Hughes, Baudot and Mercadier systems, with copious illustrations and detailed descriptions. In Part III the extra-rapid system of Messrs. Pollak and Virag, the Korn telephotograph and various telautograph and phototelegraph methods are dealt with in a full and complete manner. Other modern systems, such as the Murray automatic and Siemens phototelegraph, are not included, probably for the reason that they are not used in France.

Automatische Fernsprechsysteme. By A. B. Smith and F. Aldendorff. Berlin: Verlag S. Heimann & Sohn.

This work in two volumes is entirely devoted to descriptions of the various modern methods of automatic telephone exchanges. A full account is given of various automatic exchanges in the United States, including the well-known Strowger system, the Lorimer and the Ericsson systems. The semi-automatic system of Siemens and Halske and numerous other methods are also described. Full and clear illustrations of apparatus and mechanisms used together with explanatory diagrams are comprised. The work will appeal to engineers who are specially interested in the development of this method of telephonic communication.

BUSINESS NOTES.

The Duke of Connaught's Train.—The Royal train, comprising 10 vehicles, which was placed at the disposal of T.R.H. the Duke and Duchess of Connaught and H.R.H. Princess Patricia, during their recent tour in South Africa, was constructed at the Railway Workshops, Pretoria, Transvaal. The total length of the 10 vehicles was 624 ft. 2 in., and the tare weight 727,600 lb., or 363·8 short tons. We are informed that the whole of the carriages were fitted with Stone's electric lighting and ventilating installation, the total number of lamps on the train being 375, the electric fans numbering 24, the dining car being fitted with a power exhaust fan to remove any smell of cooking from the kitchen. The equipment of the Royal saloons consisted of 44 electric lamps, tastefully arranged in electroliers and brackets of elaborate design plated with mercurial gilt, and so oxidised to blend with the interior decorations, the shades being of maize-coloured silk of a tulip shape. Electric tail and sidelights were provided, likewise a commodious dark room fitted with ruby electric lamps and fans. A through system of bell communication, with indicators, was arranged so that the occupants of the Royal saloons were in communication with the maids, valets, or footmen, and the indicators were so arranged to point out at a glance who was required and which compartment to go to. The various accessories fitted in connection with the

electrical equipment were electric shaving water heaters, curling tongs, heaters and cigar lighters, and a vacuum cleaner, all of which derived their current from the train lighting apparatus. The Royal train was also equipped with a complete system of telephones, telegraphic apparatus and phonopores, so that the Royal party were in constant touch with the outside world in case of urgent news.

Diesel Engines.—Amongst the contracts which were recently secured by the DIESEL ENGINE CO., LTD., are the following:—

Messrs. Hoffmann Manufacturing Co., Ltd., Chelmsford.—One engine of 330-B.H.P. with 220-KW. generator (duplicate of a set already supplied).
The Athlone Wool Mills, Ireland.—One 240-B.H.P. engine.
Smithfield Markets Electric Supply Co., Ltd.—Three 270-B.H.P. engines, each with 180-KW. generator.
Barking U.D.C.—One 600-B.H.P engine, with 400-KW. generator.
The Linoleum Manufacturing Co., Ltd., Staines.—Two 200-B.H.P. engines, each with 135-KW. generator.
Colombo Tramway Co., Colombo.—One 525-B.H.P. engine for driving a 375-KW. generator.
Canadian Government, for their Pavilion at "Festival of Empire" Pageant at the Crystal Palace.—One 200-B.H.P. engine with 135-KW. generator, and one 120-B.H.P. engine, with 80-KW. generator.

Bankruptcy Proceedings.—LUDWIG LEHMANN, merchant, 68, Basinghall Street, London. A private meeting of the creditors of the above was reported recently in our columns, and the estate subsequently went into bankruptcy, a receiving order being made against the debtor. The following are creditors:

Auto Incrustation Co.	£39	Rhenania Gluhlicht Co.	£15
Abingdon Ecco, Ltd.	43	W. Saynor, Ltd.	62
Atkinson Bros.	44	Siemens Bros. Dynamo Works	213
Adie & Nephew	33	St. Helens Cable Co.	55
Birmingham Lamp and Gas Fitting Co.	42	Frank Wood	250
Brampton Bros.	37	Wallach Bros.	32
The British Lighting Development Co.	18	Albion Lamp Co.	29
G. Butler & Co.	18	Wakefield & Sons	31
Best & Lloyd, Ltd.	47	Scottish India-Rubber Co.	27
Benton & Stone	34	Welsbach Incandescent Gas Light Co.	53
J. Breedon & Co.	27	H. Hipkiss & Co.	30
A. Bailey & Co.	30	Metalite, Ltd.	144
British Westinghouse Co.	32	Doaker & Sonhan	10
Cockerell & Co.	19	Grapholine Manufacturing Co.	37
McClory & Sons	35	Lewin & Co.	466
W. Cross & Son	42	W. Auffermann	486
Calmon Asbestos & Rubber Works	39	Anglin & Co.	52
Cryselco, Ltd.	75	John Wain	58
Clipper Tyre Co.	73	Atkinson Bros.	45
De Courcy & Co.	40	Reliance Rubber and Hardware Co.	25
Dunlop Rubber Co.	18	Baxter & Caunter	64
Diamond Cycle Components and Engineering Co.	66	Bland Light Syndicate	39
Edison & Swan Co.	176	Anglo-Foreign Mfg. Co.	46
T. Ellin & Co.	15	Bunte & Remmler	178
Excelsior Gas Light Co.	13	Abram Brookes & Co.	75
Foster Engineering Co.	93	British Tungsten Lamp Co.	131
W. Geipel & Co.	53	J. McClory & Sons	35
Glover & Co.	46	Curtiss & Harvey	288
J. A. Grand & Co.	186	Cope & Timmins	87
Emil Hermes	22	Dunlop Pneumatic Tyre Co.	39
Hagedorn & Co.	54	G. Dittmann	678
Imperial Lamp Works (Brimsdown)	105	Drake & Gorham	77
H. Fraser & Co.	18	J. Fenton & Sons	98
Midland Rubber Co.	71	Grammont Alexander	411
R. F. Mosley & Co.	125	General Electric Co.	62
H. H. Slater	98	Incandescent Mantle Co.	120
J. W. May & Co.	75	Lahmeyer Electric Co.	198
North British Rubber Co.	36	Lycetts Saddle and Motor Accessories Co.	100
R. Pullen	109	H. Hooper & Co.	56
Francis Newton & Sons	16	Milton's Lamp Co.	43
Julius Norden	89	H. Miller & Co.	42
J. Nowill & Sons	52	F. Mills & Co.	52
Oliver Typewriter Co.	13	Orb Incandescent Illuminating Co.	105
C. A. Peters, Ltd.	33	Peter Union Tyre Co.	106
Plutte, Scheele & Co.	255	United Flexible Metallic Tubing Co.	43
Pope's Electric Lamp Co.	63	G. Shand	69
Paul Pippig	44	J. T. Robin	21
J. H. Potter	20	H. Wittasen & Co.	78
G. & W. Purser	46	Poelker Lighting Co.	42
Rainsford & Lynes	21		

HENRY JAMES DALE, electrician, 15, New Oxford Street, W.C., and 166, Pentonville Road, N.—Under a receiving order, the first meeting of creditors was held on Monday at the London Bankruptcy Court, before Mr. Daniel Williams, Assistant Official Receiver. A draft statement of affairs was submitted, showing liabilities £602, to rank against assets valued at £186, but subject to preferential claims to the amount of £149. The chairman reported that it appeared from the debtor's statement when before the Examiner, that he had been trading at 15, New Oxford Street, under the style of the Scientific Appliances Manufacturing Co. He obtained a lease of the premises in October, 1907, and commenced business with £950 capital, but owing £150. He took into partnership Walter Kent, a former employé, who was to receive £2 10s. weekly and one-tenth share of the profits after the second or third year. The debtor spent £300 on the premises, and the balance of his capital on stock, machinery, tools and current business expenses. In June, 1909, the debtor started another business under the style of the Eltro Dynamic Medical Appliance Co., with a view to running a medical appliance which he had invented. In order to find capital for the latter business the debtor entered into a partnership agreement with a Mr. W. T. Clarke, who provided £200 in consideration of receiving one-third of the profits after payment to him of £2 per week. The two businesses were continued until June 10th last, when the Eltro Dynamic Medical Appliance Co. was practically dead, the debtor, however, continuing to pay the £2 weekly to Mr. Clarke until December 24th last. The business of the Scientific Appliances Manufacturing Co. was continued until January 13th, when the landlord put in a distraint for his rent. A fortnight before that step was taken Mr. Clarke commenced a partnership action against the debtor and Mr. Kent for a dissolution, damages and accounts, and for the return of his capital and interest; he also obtained the appointment of a Receiver, who entered upon and remained in possession of the business until the distress was put in by the landlord. The partnership between the debtor and Mr. Kent had been dissolved on December 2nd, 1910, by mutual consent. The debtor attributed his failure to insufficient capital, heavy expenses, bad trade, and the failure of the Eltro Dynamic Medical Appliance Co. He filed his own petition on January 16th, and the sitting for public examination was fixed for March 1st next. In the absence of any offer the case was left in the hands of the Official Receiver, to be wound up in the ordinary course of bankruptcy.

G. V. B. BARKER, electrical engineer, Roundhay, Leeds, and Harrogate.—Receiving order made January 25th on creditor's petition. First meeting, February 10th: public examination, March 3rd, both at York.

JOSEPH PERKINS, electrical engineer, Plymouth.—Receiving order made January 27th on debtor's own petition.

ROBERT BROWN, director, London.—February 15th is the last day of receipt of proofs for dividend. Trustee, Mr. E. Leadham Hough, Carey Street.

WILSON RAE, electrical therapeutic specialist, New Bond Street, W.—Trustee (H. F. Kemp) released January 11th, 1911.

A Japanese Contract.—It is stated that the Berlin A.E.G. has taken over contracts for the Tokio electricity works of the value of £450,000. The German Asiatic Bank seems to act as bank for the Japanese firm carrying out the business.

E.C.C. Dinner.—The fourth annual dinner of the officials and staff of the Electric Construction Co., Ltd., was held at the Victoria Hotel, Wolverhampton, on Friday evening, 20th ult. The chair was occupied by the manager (Mr. William Bulloch), who was supported by the following leading officials:—Messrs. N. Pensabene, W. M. Furniss, J. McMillan, F. G. Jones, T. Britten, and H. H. Ostler, the following visitors also being present—Messrs. C. E. C. Shawfield (borough electrical engineer, Wolverhampton), John Roberts (borough electrical engineer, Durban, South Africa), A. W. Smith (district manager of the Telephone Co.), and A. Fyfe (Scotch representative of the company). After dinner the toast of "The Company" was ably proposed by Mr. John Roberts, and suitably acknowledged by the chairman. The toast of "The Visitors" was proposed by the chairman, Mr. Shawfield replying. The following contributed to the musical programme:—Messrs. F. G. Jones, H. R. Hudson, F. Guinness, H. A. Jones, A. B. Jones, W. J. Stay, and A. Dunn. Mr. W. G. Cliffe was an excellent accompanist. During the evening a presentation of a gold watch and chain was made to foreman Guinness in recognition of his services as hon. treasurer and secretary of various workpeople's institutions.

Trade in Russia.—It is announced that the Russian Siemens & Halske Co. has convened a general meeting to authorise the acquisition of a site for extensions. According to the principal shareholder in Berlin, the extensions are rendered necessary owing to the substantial increase in the demands made upon the capacity of the works, particularly in regard to the heavy electrical engineering branch.

Canada.—The Imperial Trade Correspondent at Toronto (Mr. F. W. Field) reports that an Ontario firm desire to receive British catalogues of cement-making machinery; and gas, gasolene and oil engines. Another Ontario firm desire to obtain British catalogues of air compressors; gas, gasolene and oil engines; and rivetting hammers.—*Board of Trade Journal.*

Tube Trade Combine.—A correspondent of the *Financial News* says that such satisfactory progress has been made with the negotiations for the reconstruction of the tube trade combine that a meeting of those interested will be held in Glasgow shortly, when definite proposals will be submitted. All the larger producers have expressed themselves as favourable in principle to combination, although certain details still remain to be adjusted. Since the International and British Tube Makers' Association collapsed in 1908 a very severe cutting of prices has been in progress. As the demand is now overtaking the supply, competition is held to be useless.

"Philips U.K."—In future Messrs. Boddy's "Metalik" lamps will be known by the name of "Philips U.K." (United Kingdom).

Jamaica.—The *Times* reports that there is a movement on foot for holding an international exhibition at Jamaica to celebrate the opening of the Panama Canal.

Partnership Notice.—According to a notice in Tuesday's *London Gazette*, Messrs. Kelvin & James White, Ltd., now cease to be a general partner, and become a limited partner, in the firm of Kelvin & James White, Ltd., and Hutton, carrying on business as nautical opticians at 11, Billiter Street, E.C. The notice is signed by Kelvin & Jas. White, Ltd., J. T. Bottomley and F. W. Clark, directors, W. Fotheringham, secretary, limited partner, and G. Hutton, general partner.

Private Meetings.—EDWARD BODDY and JOHN SWALES, trading as the Hartlepools Armature Winding and Repair Co., 26, Whitby Street, West Hartlepool, electrical engineers.—The creditors interested in this matter were called together a few days ago, when a statement of affairs was presented, showing liabilities of £280. The indebtedness to the trade was £247, and the balance of £32 10s. was owing to cash creditors. The net assets were £120. It was reported that the debtors had been in business for about four years, and their present position was attributable mainly to losses on unprofitable contracts and lack of working capital. The debtor Swales had also been in ill-health for some time past, and had

been unable to devote his energies to the business. In the absence of any offer by the debtors, the creditors decided that a deed of assignment should be executed to Mr. T. R. G. Rowland, accountant, of West Hartlepool. The trustee was recommended to offer the stock in trade for sale by tender, and to dispose of the remaining assets as soon as possible.

G. Lambert, electrical engineer, 188, Rye Lane, Peckham, London, S.E.—The creditors of the above were called together recently, but the usual statement of affairs was not presented. From figures which had been given by the debtor, it appeared that the liabilities amounted to £730, while his assets were £207, the latter consisting of book debts £77 and stock in trade valued at £130. The principal creditors were the General Electric Co., whose claim was in excess of £300. It was stated, in answer to a question, that the debtor's figures had not been verified by a professional accountant. Up to about three years ago the debtor was in employ at West Ham, but he then started trading for himself. He first took an office at Holborn, but only remained at that address for a comparatively short time, and then removed to his present premises. The shop at Rye Lane was held on a lease for 21 years, at a rental of £80 per annum. The debtor stated that when he commenced trading for himself he had little or no capital of his own. His present position had been brought about by losses on contracts. The debtor had entered into negotiations with a gentleman who proposed to join him as a partner, and introduce capital to the extent of £500; but when the matter was almost settled, the prospective partner withdrew. Subsequently the debtor found that he could not obtain the necessary financial assistance, and consulted his solicitors, who advised him to call his creditors together. After discussing the position, the creditors decided that the matter should be dealt with under a deed of assignment, with Mr. G. E. Corfield, accountant, of Messrs. Corfield and Cripwell, Finsbury Pavement House, E.C., as trustee.

Book Notices.—*Science Examinations, 1910.* London: Wyman & Sons. Price 9d.—This volume contains the Science Examination papers and the Examiners' reports, which have hitherto appeared in separate volumes, and the names of successful candidates in Honours. The examiners, as usual, complain of the deficiencies of candidates in respect of English composition and simple arithmetic. Ignorance is also shown of certain simple but fundamental facts, which indicates inefficiency in the teaching. From a perusal of various reports, we infer that there is a general lack of *precision* in the knowledge possessed by candidates; they spread themselves on descriptive work, but fall into error when numerical results and curves are required. Want of thought is also plainly evident. Nevertheless, the tendency seems to be towards improvement in the work, as compared with previous years.

"L'Année Electrique, Electrotherapique et Radiographique." By Dr. Foveau de Courmelles. 1911. Paris: Ch. Beranger. Price 3.50 fr.—This annual is now in its eleventh year; it covers the whole field of electrical activity, and constitutes a remarkable summary of the progress made in all branches during the past year. The bulk of it is devoted to subjects of interest mainly to medical men, but the editor shows a lively interest in matters outside his more immediate sphere of labour, and quotes innumerable items of all kinds—some quaint, some trifling, but the majority readable and interesting.

Workshop Wrinkles and Recipes. Edited by Percival Marshall. London: Percival Marshall & Co. Price 1s. net.—Next to possessing a store of "wrinkles" derived from one's own experience, the best thing, no doubt, is to tap some one else's hoard of knowledge—a process usually described by the suggestive phrase "sucking his brains." Not everyone is willing to submit himself to that operation. Mr. Marshall, however, combines with an accumulation of practical wrinkles of exceptional scope an altruistic desire to let all men share it with him. The number and variety of the hints given in this book, with clear illustrations where necessary, defy detailed reference, but we have read many of them with interest and profit, and can confidently recommend the collection as thoroughly practical and useful to anyone engaged in the workshop, especially amateur model-makers.

University of Leeds: Annual Report, 1909-10.—The seventh report records the installation of the Duke of Devonshire as Chancellor, and details the progress made during the year in the various departments. The staff of the Department of Electrical Engineering has been fully occupied in completing the equipment and organisation of the department during the year, and in carrying on the routine work. Various useful researches have been carried out in other departments.

"Mésures Electriques Industrielles." By J. A. Montpellier and M. Aliamet. 1911. Paris: Dunod & Pinat. Price 18 fr.

"Atti della Associazione Elettrotechnica Italiana." November-December, 1910. Milan: Rebeschini di Turati.

"The Physical Review." Vol. XXXII, No. I. January, 1911. Lancaster, Pa.: The *Review* Offices. Price 65 c.

"Engineering Mathematics." By C. P. Steinmetz. 1911. London: Hill Publishing Co., Ltd. Price 12s. 6d. net.

"Hydraulic Turbines." By V. Gelpke and A. H. Van Cleve. 1911. London: Hill Publishing Co., Ltd. Price 17s. net.

"Electricity in the Service of Man." Vol. I: The History and Principles of Electrical Science. By R. Mullineux Walmsley. London: Cassell & Co., Ltd. 1911. Price 7s. 6d. net.

Catalogues and Lists.—The Magnolia Anti-Friction Metal Co. of Great Britain, Ltd., 49, Queen Victoria Street, London, E.C.—Catalogue of 80 pages containing full particulars of their "Flower" brand magnolia metal. General information concerning the application and soldering of the metal, results of tests, reports by experts, and many testimonials from users are given, while a number of pages are occupied with calculation tables (conversion to metric, areas and circumferences), and a number of pages are set apart for diary purposes.

Messrs. A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.—New pamphlet No. 51 giving revised prices and particulars of the firm's isolating switches, made in sizes suitable for circuits up to 10,000 volts.

Messrs. Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W.—New and revised illustrated price list of steel conduits and conduit fittings.

Messrs. Bell Bros. & Co. (London), Ltd., 104, Bishopgate, London, E.C.—Folding circular illustrating and giving Press notices of the Evans twin-grip pendant lampholder.

Messrs. Alfred Herbert, Ltd., Coventry.—36-page pamphlet, containing descriptive particulars of the firm's horizontal milling machines, their construction and duties.

Messrs. Pooley & Austin, of 25, Victoria Street, London, S.W., have sent us a useful desk ruler which will remind us in a quite unobjectionable way of their complete generating plants, electric motors, metal-filament lamps, switchboards and cables.

Messrs. David Rowell & Co., 31, Old Queen Street, S.W.—Illustrated folding pocket lists regarding their patent ventilators, also their engine sheds, iron and steel roofs, and other structures.

Messrs. J. C. Fuller & Son, Woodland Works, Wick Lane, Old Ford Road, Bow, E.—New catalogue (60 pages) giving illustrated particulars and prices of a variety of electrical and automobile accessories (1911 models). In addition to ignition coils, accumulators for carriage lighting sets, car roof lights, side lamps, hand lamps, car switches, magnetos, charging batteries, condensers and dry cells, there are details of the Fuller system of electric lighting for motor-cars, electric geysers, electric cooking apparatus, fans, motor tires and many other accessories. Messrs. Fuller will send copies of this catalogue to anyone in the electrical trade who is interested in this increasingly important department which electrical supplies firms will do well to foster, in view of the remarkable motor-car development that is proceeding

Annual Supper.—The foremen and deputy foremen of Messrs. A. Reyrolle & Co., Ltd., Hebburn-on-Tyne, held their annual supper at the Ellison Hotel, Hebburn, last Saturday evening. Mr. W. A. Harriman (works manager) occupied the chair. After the repast a musical programme was rendered by various members.

Turbo-Plants for Abroad.—Messrs. Jens Orten-Böving & Co. have just received an order from the Hiroshima Electric Light Co., of Japan, for three Francis water turbines of 1,300 B.H.P., and one exciter of 110 B.H.P., to work under a head of 44·8 ft.; also an order for a turbine of 340 H.P. at 54 metres head, for the Companhia Fiacao E. Tecidos Unicio Lavrense. Other orders include Victoria turbo pumps for the Indian and other Government departments.

Trade Announcements.—Messrs. Siemens Bros. Dynamo Works, Ltd., Incandescent Lamp and Fittings Department, Tyssen Street, Dalston, N.E., announce that in future their "Dalston 4" line will be cancelled, this line having been replaced by three lines on the Dalston exchange. With the three central lines there will be a range of six lines, the numbers being as follows:—Central 8387—8388—8389, and Dalston 2440 (three lines). Many internal extensions have been made.

Mr. A. Ogilvy Webb has opened offices at a convenient position in the City, namely, 63, Finsbury Pavement, when he will, as "The Moorgate Drawing Office," do business in all classes of drawing, designing, tracing and photo-printing. Telephone, "No. 7695 London Wall."

The offices of The Horsfall Destructor Co., Ltd., have been removed from 15 to more commodious premises at 17, Victoria Street, Westminster, S.W.

Mr. H. Garstang, electrician, has removed to new premises in Darwen Street, Blackburn.

Mr. Harold Watson has taken the premises recently occupied by the Holland House Electrical Co., Ltd., at 121A, St. Vincent Street, Glasgow, and will carry on the business in electric fittings, and electric heating and cooking apparatus, formerly carried on by the company, having completed arrangements for the sole representation in Scotland of Messrs. Spital & Clark.

Messrs. S. Wolf & Co. are removing to larger premises at 115, Southwark Street, London, S.E., on February 6th. Their telephone number and telegraphic address remain unaltered.

Liquidations.—London Sherardising Co., Ltd., Western Sherardising Co., Ltd., Sheffield Sherardising Co., Ltd., Birmingham Sherardising Co., Ltd.—These companies are winding up voluntarily, with Mr. C. J. Bush, 6, Great Winchester Street, London, E.C., as liquidator. Meetings of creditors were called for that address on February 1st.

Contraflo Condenser Co., Ltd., and Contraflo Continental Patents Co., Ltd.—Meetings are to be held at 3 and 5, Crown Court, E.C., to hear an account of the winding-up from the liquidator, Mr. W. S. Gregg.

Dagenham.—The electrical engineering department of the Thames Ironworks Co., Ltd., is at present extremely well occupied. In addition to having sufficient ordinary work to keep the branch going at full pressure for some months, there is the extensive installation required for H.M.S. *Thunderer*, which was launched on the 1st inst. A good start has already been made on the vessel with the ring-main cables. The company is at present busy with its scheme for electrifying its new works at Dagenham and the supply of the necessary energy for the power and lighting on the warship during the time she is berthed there for completion. In the course of a few weeks the company will be engaging a large number of expert wiremen for the ship work.

E

Consular Notes. — Egypt. — The Austro-Hungarian Consul at Alexandria reports that the use of gas and electric lighting is rapidly extending in the country. Electric lighting materials required are imported chiefly from Berlin and Milan. In incandescent lamps Germany has the largest trade, and at the present time metal-filament lamps are generally in demand, so that existing stocks of carbon-filament lamps are difficult to dispose of. Glass parts for lamps, such as shades, globes, &c., are mostly supplied by Austria-Hungary, Germany and France.

Bolivia. — The British Vice-Consul at Sucre reports that a very careful investigation of the country of origin of all imports has led him to believe that the proportion contributed by the United Kingdom is rather larger than appears from the official statistics for the reason that a large part of it is embarked in ports other than British. British trade is mostly in the hands of German, American and French firms who know what the customer requires and who get it from the most convenient source. This undoubtedly shows that British manufactured goods by their special worth, have been taking very good care of themselves, but it does not show that they will always continue to do so in the future without British traders making special efforts to bring them prominently before the consumers so that the fullest advantage is taken of their superiority. In the first place, German and American manufacturers who have their agents or correspondents in Bolivia are making strenuous efforts to imitate or substitute German or American goods for every article that is made more exclusively in other countries. In the second place, if they do not immediately succeed in imitating some staple articles of British manufacture, they do succeed sometimes in adapting some of them better for local requirements, or in setting another fashion. Such firms as are wholly or partially under German, American or French management have their connections in Europe, who buy for them and in most cases allow them some credit, but these rarely have agents in the United Kingdom. Native firms do not seem to have any connections whatever in the United Kingdom, and they do not seem to know to whom to apply for orders for British goods. Commission and general agents desirous of extending their business in Bolivia—and this same may apply to manufacturers—are advised to endeavour to get into communication with the importers in Sucre and Potosi by means of circulars and catalogues printed in Spanish, with the weights in kilograms and fractions thereof—prices are better in English money—giving the fullest possible information as to commission charged, trade discounts allowed, prices f.o.b. and terms of payment. When prices c.i.f. Antofagasta or Rosario de Santa Fe can be quoted, it is an inestimable help to the merchant in Bolivia. The aim must be to avoid compelling the merchant in Bolivia always to keep an account current with the agent when he might remit just the necessary amount. Agents and manufacturers should state clearly whether they are disposed to execute orders and draw for the amount at the time of shipment or to grant any further extension of credit. Some credit can be safely given to many firms; some are old-established firms, who have owned property for generations and can be relied on, but in order to avoid unnecessary risks, inquiries should generally be made as to the standing and credit of firms. Their commission is ½ per cent.

What special inducements Bolivia offers for the extension of British trade, in face of the very active competition of other foreign countries, may be summarised as follows:—It is a new country with great undeveloped resources, superior in that respect to many of the other South American Republics—for none can rival it in the production of tin—and in other respects is very much like its neighbours, except that it is in a different stage of development. Its development is naturally retarded while the neighbouring countries on the Atlantic and Pacific seaboards are more accessible to immigration and foreign capital. Still, Bolivian import trade has trebled in the last 10 years. Though the circumstances which have contributed to this may be abnormal, the railway system is being rapidly extended, new country is being opened up and peopled, and new necessities for the comfort and luxury of the people will be created in communities brought for the first time into contact with the outer world. With the railway development there will be a corresponding expansion in exports, which, plus the reduction in freights for both outgoing and incoming commodities, must necessarily swell the consuming capacity of the country.

LIGHTING and POWER NOTES.

Argentina. — The output in connection with the Buenos Ayres electricity works of the German Transmarine Electricity Co. exceeded 45,000,000 KW.-hours in 1910. According to the terms of the company's concession, the city inspector has reported the fact to the city authorities, and informed them that in accordance with the concession the company has to reduce by 10 per cent. the charge for supply of current for lighting and heating purposes in the present year.

Australia.—Tenders have been received by the Electric Committee of the Melbourne City Council for 6,000 metal-filament lamps, which are to be used for displacing carbon-filament lamps for street lighting purposes. On January 1st the Council started on the consumption of Powlett coal at the electricity works, having bought 35,000 tons. It has installed a centrifugal pump at the pump house on the river side for circulating water which brings up the pump capacity to nearly 1,300 H.P. Two new sub-stations are being erected in the alternating-current area, viz., one at Broughton Street, North Melbourne, and the other at Pigdon Street, Carlton. Mr. H. R. Harper, city electrician, is leaving for a tour in England, America and the European Continent, by the *Malwa*, sailing on February 15th, and he expects to be away from Melbourne for between seven and eight months. During his tour, which is undertaken on behalf of the Melbourne City Council, he will inspect various types of electrical machinery which are likely to be suitable for the Melbourne electrical supply, paying special attention to battery plant, as it is proposed to install in Melbourne, on his return, a large battery.

Barnstaple.—Under the scheme to "push" the use of electricity, the T.C. has appointed Messrs. H. R. Williams & Co., a local firm of ironmongers, as the "official electrical repairers and contractors to the Corporation," upon such terms as may be agreed. By this appointment the firm will have certain preferential terms for the supply of current for exhibiting electrical fittings and appliances.

Bedford.—The T.C. has decided to apply to the L.G.B. for a loan of £22,837 for E.L. purposes for five years. The sum includes £5,778 which remains unspent of a loan sanctioned in 1904.

Belfast.—At the weekly meeting of the Tramways and Electrical Committee, the electrical engineer submitted a return of the electricity revenue up to December 31st, 1910, showing a total revenue for the year of £46,790, or an increase of £6,470, this being exclusive of the current supplied to the tramways.

A strike which took place among the "doffers" at the Braidwater Flax Mill, Ballymena, is stated to be due to demands for increased pay, to make up for harder work consequent on the introduction of electric driving.

Birkenhead.—Through the bursting of the main exhaust steam pipe at the Bentinck Street electric lighting station on January 25th, all the electric lighting on the Corporation service was extinguished, and the tramway service had to be suspended. The adjoining Craven Street generating station, however was not affected, and the machines, which had been running on the tramways, were as soon as possible utilised solely for electric lighting purposes. Mr. W. Wyld (electrical engineer and tramway manager) was early on the scene, temporary repairs were effected, and within half-an-hour the lighting load was re-transferred to Bentinck Street, and the supply to the tramways restored. The lighting circuits were restored within 12 minutes. The cause of the mishap was the flooding of the main exhaust pipe with water from a new condenser that was being run on load for the first time, and this is the first occasion on which an accident of this sort has occurred during the 15 years' history of the electricity works.

Bolton. — A correspondent informs us that the individual drive is being adopted in a weaving mill to contain 700 looms, now being erected for an East Lancashire firm at Bradley Fold, near Bolton. This somewhat tardy trial of a system much favoured abroad, will be watched with interest, especially by the "group drivers."

Bradford.—At the monthly meeting of the Chamber of Trade, it was reported that the proposal of the Corporation to sell electrical goods was still being considered, and correspondence had taken place with the town clerk in regard to the matter. The Electrical Contractors' Association (Incorporated), West Yorkshire branch, have the matter in hand, and it was stated that although the electricity department was now selling from its showroom in the Town Hall, had been negotiating for a shop, and had even offered to sell goods and send them on approval to members of the Council of the Chamber, the Electrical Contractors' Association was hoping to be able to arrange the matter privately to its satisfaction. The Chamber, therefore, was taking no action in regard to the matter at present.

Burnley.—Having considered a report of the engineer as to the need for providing additions to the generating plant, the Electricity Committee has decided to install a 1,200-KW. turbine plant with tandem generators, and a motor booster for lighting purposes, at an estimated cost of £8,129. It also decided to lay a cable from the Centre to the station, at a cost of £240. The L.G.B. is to be asked to sanction the outlay.

Cirencester.—The U.D.C. has decided to give its sanction to the E.L. order being applied for by a company, on the promoters agreeing to certain amendments.

Continental Notes.—ITALY.—The Conti (Italian) Electrical Co. was founded in 1901, and has become one of the most important of those producing and distributing electrical energy in Italy; it is interested directly or indirectly in some 20 undertakings serving a population of 720,000 located in and around Monza, Novara, Alessandria, Pavia, &c. It operates six hydro-electric and three steam generating stations having a total of about 60,000 H.P., whilst the concession has now been obtained for the construction of a seventh hydraulic works, which is estimated to develop 20,000 H.P., and the steam stations are laid out with a view to ultimately increasing their output by a further 20,000 H.P. The present total supply amounts to 200,000,000 units per annum, and part of this has been purchased from neighbouring undertakers pending the completion of the projected works. The bulk of the generating is done at about 3,000 volts, and transformed up for transmission, but at Majenta a three-phase "Gadda" alternator works at 7,200 volts, whilst the energy from the hydro-electric works at Zogno is transformed up to 25,000 volts single-phase and

distributed as far as 32 km. The water-power plant at Foppiano yields nearly 10,000 H.P., and was set to work as recently as June, 1909; the three-phase alternators are coupled to Pelton wheels of 3,600 H.P. each and generate at 7,400 volts, which is raised to 56,000 volts for transmission.

RUSSIA.—It is reported that a Commission is about to be nominated to investigate the possibility of utilising the Falls of Terek (near the Lars Railway Station) and Lake Goktscha (in the Government of Eriwan) for the generation of electricity and its distribution throughout the Caucasus.—*Nachrichten für Handel.*

Fochabers.—The supplementary steam-generating plant in connection with the Gordon Castle electrical installation has been completed and tested. Both this and the original water-power plant have been installed for the Duke of Richmond and Gordon.

Halifax.—At a monthly meeting of the T.C., the Watch Committee is to recommend that the electrical arc lamps recently erected in Northgate for experimental purposes should be allowed to remain there permanently.

Haslingden.—The T.C. has adopted a scale of charges for electricity. These include:—Churches, workshops, &c., 5d. per unit; lock-up shops, 4½d.; and private users, 4d. Power up to 500 units, 2d.; for next 500, 1½d.; up to 1,500, 1½d.; up to 2,000, 1¼d.; and additional units, 1d.; heating and cooking, a flat rate of 1½d. A committee was appointed to consider a scheme for lighting the Corporation buildings with electricity.

Heywood.—Mr. H. R. Hooper (L.G.B. Inspector) held an inquiry on January 25th and 26th relative to the application of the Town Council for sanction to borrow £4,000 for electricity extensions. On behalf of the Corporation it was explained that much of the work had been done for which powers were now sought. It was necessary to go on with it, as a matter of urgency, in the interests of the department. The Inspector accepted this explanation, though emphasising at the same time the fact that the Board had strongly condemned the practice of spending money before sanction had been obtained. Eventually the application was amended to £4,355, which would include all capital expenditure incurred and contemplated within the next two years. Mr. Hooper remarked that he did not think the undertaking would be profitable for some years to come.

High Wycombe.—The T.C. has decided to renew the contract for street lighting with the E.L. company, and has approved of the company's application for a prov. order extending the area of supply.

Hastings.—The T.C. has decided to supply current for outside lighting by means of high candle-power metal-filament lamps, ordinary lamps, or otherwise, at the arc lamp scale of 4½d. per unit, subject to a three years' agreement.

Heston and Isleworth.—The Council has adopted recommendations of the Electricity Committee that the price of electricity supplied through ordinary meters and on premises not free-wired by the Council, for private lighting purposes, be reduced to a flat rate of 4d. per unit; and that as an alternative, consumers may be allowed to adopt the "telephone" system of charging by paying a fixed charge at the rate of £20 per KW. per annum for the maximum current demanded, and 1d. per unit for all consumed.

Kirk Onchan (Isle of Man).—The parish church here is the first place of worship in the Isle of Man to be lit by electricity. There are 22 55-C.P. and 15 32-C.P. lamps installed.

Llandudno.—The net profit of the Council's electricity undertaking for last year amounted to £953. Of this amount £37 was added to the depreciation account, £400 went to relief of rates, and the balance was carried forward. The depreciation account now amounts to £3,425.

London.—BETHNAL GREEN.—The Council in June last decided to adopt the Shoreditch B.C.'s alternative flat-rate scheme for the supply of electricity for seven years. On July 21st the agreement between the Council and the Shoreditch B.C. was submitted to the Council, and the instructions of the Council invited as to sealing the agreement. The Council passed no resolution. Since then to avoid delay during the autumn vacation, the Council of Shoreditch made application to the B. of T. with a view to the Board giving its sanction to the agreement. In accordance with the Act of Parliament, the opinion of the County Council was invited on the proposed agreement, and the County Council submitted its observations to the B. of T. and furnished to Bethnal Green B.C. and to Shoreditch Council copies of the observations. The B.C. has agreed to various amendments, and it is anticipated that the B. of T. will sanction the agreement.

POPLAR.—The Electricity Committee has under consideration the question as to the provision of a showroom on one of the main roads with a view to increase of business by demonstrating the uses to which the facilities offered by the undertaking may be put in respect of lighting, heating, cooking, &c. It is also suggested that the commercial offices of the undertaking be removed thereto. An ambulance with first aid appliances is to be obtained for the electricity works at a cost not exceeding £20.

The Highways Committee of the L.C.C. has had under consideration the proposed agreement under the London Electric Supply Act, 1908, between the Poplar and Stepney B.C.s, in regard to mutual stand-by supply facilities. The Committee views the agreement favourably, but it considers that certain amendments are desirable, more particularly in the definition of the clauses, and it has asked the B. of T., in the event of its approving of the arrangement, to consider the suggested amendments.

The Hon. Secretary of the Associated Municipal Electrical Engineers has written to the Metropolitan B.Cs. and other local governing bodies calling attention to the provisions of the Metropolitan District Railway Bill, seeking powers to enable the railway company to supply electric current in many places where, at present, existing supply authorities have the sole right.

Loughborough.—The Highways Committee of the T.C. has under consideration the question of converting all the street gas lamps along the line of the electric cables for electric lighting. Figures were produced by the electrical engineer and by the gas engineer, and the Committee decided to recommend the conversion, but before the matter came before the full Council, amended figures were produced by the gas manager. Things are now in abeyance until the fullest information can be obtained.

Manchester.—The conferences in connection with the working of the gas and electricity undertakings have so far resulted in the case for the Gas Committee being outlined by Ald. Gibson, its chairman.

The chairman of the Electricity Committee considered the statements onesided, naturally, and is preparing an answer on behalf of his department.

Newport (Mon.).—Owing to threatened proceedings against the Corporation by the Ratepayers' Association with reference to the finances of the electricity department, the T.C. is to take counsel's opinion on the position.

Nova Scotia.—According to *Commercial Intelligence*, there are over 140,000 electrical street lamps in use in various townships, and 10,000 were added last year.

Plymouth.—The Electricity and Street Lighting Committee has received the return of the engineer upon the working of the electricity undertaking for the quarter ended December 31st last. It shows a sale of 778,798 units, and estimated receipts of £8,161, compared with 730,318 units sold, and £7,924 received in the corresponding period of the previous year. The cost of the current supplied to the Corporation tramways was £2,225, a reduction of £8, and miscellaneous receipts of £117 were £57 less. On the other hand, the supply of current for private lighting produced £4,711, compared with £4,517, and for private motors £451, as against £344. The net increase of revenue on the quarter was £237. At the end of last month the number of consumers was 1,251, against 1,104, and the lamp connections 91,855, compared with 86,339. The Committee considered the estimates of income and expenditure in connection with the undertaking for the financial year ending March 31st, 1912. The income was estimated to produce £26,585, compared with £24,750 for the current year, and the expenditure, other than capital charges, was estimated at £15,290, against £14,360, leaving a gross profit of £11,295, as against £10,120 this year. The gross profit, together with a sum of £235, interest on reserve fund, making a total of £11,530, is proposed to be appropriated as follows:—Interest, £4,708; sinking fund charges, £5,250; new cables and meters, £1,000; leaving a net balance of £572, compared with £497 this year. On the street lighting account the Committee estimates to spend £6,946, as against £6,916, allowed for the current year.

Reading.—The *Reading Standard* on Saturday last devoted a special supplement to electric lighting, heating and power matters. It is well illustrated, and should usefully help to popularise the uses and advantages of electricity among the readers of that paper.

Salford.—The Electricity Committee of the Corporation is at present considering a scheme for extending the works. The demand made upon the generating station in Frederick Road has caused the Committee to consider the advantage of utilising the old station in Wallness Road. To do this the tramway manager has under consideration a scheme whereby coal may be conveyed in electrically-equipped wagons over the existing tramway system from one station to the other. In all probability the Electricity Committee at an early date will adopt the scheme.

Sidmouth.—At a meeting of the U.D.C., the General Purposes Committee reported that it had considered the proposal for electric lighting, and as it was of opinion that it would be prejudicial in many ways to the interests of the ratepayers, it recommended the Council to file a petition in opposition to the proposal. This was agreed to.

Smallthorne.—The Stoke-on-Trent T.C. having been applied to for a supply of current to the Milton district, it has been ascertained that the request cannot be complied with, as the Corporation has not the power to supply energy in the district mentioned.

South Africa.—DURBAN.—Fire broke out in the machine shop of the Government Railway Works recently, but was subdued before any great amount of damage had been done. The works are electrically-driven, and the switchboard controlling the motors in the shops was destroyed; it was considered that work would be stopped in the department for a few days, although the machines were practically uninjured.

Stoke-on-Trent.—At a meeting of the T.C. on January 26th, it was decided to request the Education Committee to consider the advisability of lighting all the schools under its control in Hanley and Tunstall with electricity. It was considered that the lighting for these schools should be supplied by the Council, and not by private gas companies.

For the steam supplied by the refuse destructors to the electricity works, the T.C. has decided to pay £400 per annum in the case of Stoke, and £200 per annum in the case of Burslem.

The T.C. has decided to give a supply of electricity for Coronation illuminations at 1d. per unit net for all energy in excess of that taken during the corresponding period of the previous year.

U.S.A.—The *Journal of Electricity* mentions that the Pacific Coast Power Co. has ordered from the Allis-Chalmers Co. two 20,400-H.P. reaction turbines in connection with a new development on the White River, about 20 miles east of Tacoma. The turbines are to operate under a head of 480 ft., and will be direct-coupled to 60-cycle, three-phase, 6,600-volt generators; 500-H.P. exciters will be installed. Our contemporary states that these turbines exceed anything previously built in both size and power.

Wakefield.—The West Riding of Yorks C.C. has decided to appoint a sub-committee to confer with the County Hall Committee to see if it can get an E.L. installation to serve both the County Hall and the new police headquarters, which are to be erected at a cost of £32,000. It has been found that the County Hall Committee cannot produce energy cheaper than it can obtain it from the Wakefield T.C.; it is thought the two would probably be able to do so if the Committee had its own installation.

Wimbledon.—The town clerk reports that objections have been made by the Kingston-upon-Thames Gas Co., and the County of London Electric Supply Co., Ltd., to the granting of a prov. order authorising Wimbledon to supply electricity in the U.D. of the Maldens and Coombe. The Gas Co. asked for a clause rendering it obligatory upon the Maldens and Coombe U.D.C., to revise periodically the prices to be charged by it for electricity. The town clerk of Wimbledon has consented to the insertion of such a clause. The County of London Electric Supply Co., Ltd., asked that the order applied for should not be granted on the ground that it would be necessary for the supply mains from Wimbledon to Maldens and Coombe to be carried through certain parishes in which the company claims to have powers to supply electricity. The Wimbledon town clerk reports that the company's objection was irrelevant and unjustifiable, and he was preparing a reply to that effect for submission to the B. of T. For the year ending December 31st, 1910, there was an increase in the number of lamps applied for in 35-watt equivalents from 168,952, to 170,244. During the same period, the number of customers had risen by 327, there being now 4,243 upon the books.

TRAMWAY and RAILWAY NOTES.

Altrincham.—A Manchester correspondent informs us that it has been decided to electrify the Manchester, South Junction and Altrincham Railway. This particular suburban route is controlled by the Great Central and London and North-Western Companies, and it is understood that arrangement have been made for carrying out the work within the next three months. It is understood that a 15-minute service will be run normally, and it is hoped to attract back again some of the traffic lost to the tramways.

Blackpool.—The last remaining relic of the electric conduit tramway system is now being removed. Workmen on Tuesday began pulling up the tramway in Station Road, where the only length of the old conduit system is in existence, preparatory to the re-laying of the track.

Burnley.—The Corporation has decided to relay the tracks in the centre of the town, so as to have better regulation of the traffic. The alteration will cost the tramways department £800.

Canada.—The plans for elevating the Grand Trunk lines in Montreal have been prepared. Trains within the city will be hauled by direct-current electric locomotives, power being obtained from the Canadian Light and Power Co.'s station at St. Timothy.

Chile.—The Camera of Deputies, on the proposal of the Minister of Public Works, will discuss the question of establishing electric traction on the railway from Santiago to Valparaiso.—*The Electrician*, Milan, December 1st, 1910.

Continental Notes.—ITALY.—For some few months now the goods trains on the old Giovi lines between Pontadecimo and Busalla have been worked by electric traction; the usual traffic has amounted to 18 trains per day, each of 540 tons, and with two electric locomotives—one pulling and the other pushing—it has been possible to attain a speed of 45 km. per hour. Now it is intended to increase the weight of the trains to 680 tons, and to do this a third locomotive will be coupled behind. It is hoped soon to deal also with the passenger traffic over the line by electric traction; the total length is about 10½ km., and the maximum gradients 3½ per cent. with curves of 400 m. radius. The generating station is steam driven, containing seven Babcock boilers and two turbo-alternators, each capable of working up to 6,250 KW. The electrical plant works at 13,000 volts three-phase, 15 periods. The energy is transmitted by two separate lines to the sub-stations along the route (four in number), where it is reduced to a pressure of 3,000 volts; lattice steel poles are used to carry the lines, with intermediate tubular poles, to reduce the lateral oscillation. 25 electric locomotives have been supplied; they have five wheels coupled, each 1·07 m. diameter, the total weight of each being about 60 tons, and they are fitted with two high-tension three-phase motors, which can be worked in parallel or in cascade with resulting velocities of 45 or 22½ km. per hour.

The inauguration of an electric railway, a distance of 7 km. along the edge of the Lake Maggiore, has taken place. In connection with the ceremony, one of the Under-Secretaries of State promised Government assistance towards the construction of a continuation of the line as far as Omnega on the Lake of Orta.

On the initiative of Engineer A. Pariani, a promoting syndicate has been formed with a view to constructing a narrow-gauge railway to connect Intra and Premeno, with halting places at the intervening villages. The proposed railway will materially assist the agricultural work carried on in this fertile neighbourhood, and will also open up valuable sites for dwellings.

A company with a capital of £40,000, is being formed to construct and work an electric tramway between Pont San Martin and Gressoney.

The conditions attaching to the construction of the Locarno-Bellinzona tramway have now been published. The length of the line is 12·4 km., 1 m. gauge, maximum gradient 5·74 per cent., minimum curve 25-m. radius. There will be seven stations, and with electric traction the estimate works out at 80,000 liras per kilometre. The construction is to be started within six months of the approval of the plans.

GERMANY.—The inauguration of trial runs on the Dessau-Bitterfeld main line has been commenced with two Siemens-Schuckert locomotives, which have attained speeds of 62 miles an hour with loads up to 350 tons. Experimental runs with electric locomotives made by other firms will shortly take place.

A public service of railless electric motor-vehicles has just been established between Heilbronn and Bockingen (Wurtemburg), a distance of about four miles. The Mercedes-Stoll Electrique system has been adopted.

SWEDEN.—Contracts have been signed by the Swedish General Electric Co., of Västeräs, and the Siemens-Schuckert Werke, for the construction of the Swedish State Railway Department of the generating station at the Porjors Falls, and the electrification of the State frontier railway. Preliminary trials are to be carried out in Germany with an electric locomotive suited to ore transport, and the Swedish State Railway Department will build a line from Gullivara to the falls, for the forwarding of the imported material and rolling stock. The construction of this line has already begun. The electrification is stipulated to be completed by 1914.

DENMARK.—The electrification of old and new railway lines is absorbing the attention of those technically concerned in Denmark as elsewhere. In Copenhagen the building of the large new passenger station has given occasion for the rediscussion of the question of introducing electric traction on the short-distance lines. In the provinces also electrification is under consideration, and steps in this direction are being taken. Thus, in Jutland the new line from Aarhus to Kanders is to be electrically worked, while the old steam line from Odensee to Svendborg is in course of transformation.—*Elektrotechnik und Maschinenbau.*

HUNGARY.—A 60-year concession has been granted by the Hungarian Ministry of Trade to a local compauy to build and work electric tramways in the free city of Ujvidek. The system is estimated to cost 1,562,800 kr., of which 419,000 kr. is allotted to rolling stock.—*Elektro. u. Maschin.*

Coventry.—The City Council on Tuesday decided to give the local tramways company formal notice of its intention to purchase the system, terms to be agreed upon or decided by arbitration.

Dunoon.—Some advance was made with the proposed scheme of tramways between Dunoon and Sandbank at last week's meeting of the T.C. The observations made by the promoters, in reply to the conditions laid down in the draft agreement by the T.C. at a previous meeting, were considered in private. It is understood, however, that the promoters now wish the Council to be at the expense of erecting the plant necessary for generating electricity—estimated to cost from £8,000 to £10,000—which idea the members of the Council refuse to entertain. The Council also refused to agree to the promoters' suggestion that certain ground should be acquired for street widening, and that the Council should undertake the carrying out of the work at the promoters' expense. The paving of the track with their setts was waived, provided the company lay the whole of Argyle Street with tar macadam, and provide for its upkeep. Several minor details were also adjusted.

Liverpool.—The city treasurer's accounts of the two undertakings show that the tramways for the past year have resulted in a net profit of £98,266, while the electric supply accounts indicate a net profit of £46,529. It is proposed to devote £25,000 of this profit in relief of the rates.

London.—The Brighton Co.'s report for the next half-year mentions the great revival of the third-class traffic, in which there has been an increase of nearly three million passengers, as compared with the same period last year. This is attributed largely to the inauguration of electrical services on the railway. The capital expenditure during the six months, £115,712, was also largely due to the electrical equipment of the Crystal Palace lines. At the half-yearly meeting of the South-Eastern and Chatham Railway Co. references were made to electrical working, but, so far, neither concern appears inclined to take any action in the matter,

preferring, apparently, to relinquish the short-distance traffic, if need be.

At the last half-yearly meeting of the East London Railway, Lord Claud Hamilton stated that the question of system of electrification had been settled, as it had been shown that they could not use the overhead single-phase system in the tunnels, which were not high enough. Further, the physical connection of the line with the Metropolitan and Metropolitan District Railways influenced the directors in favour of a D.C. third-rail system. It was possible that those companies might assist in the work financially, and others might join also. The survey of the line by a leading electrical company was practically completed.

LEWISHAM.—The General Purposes Committee has decided in favour of contributing one-third of the estimated net cost (£43,500), of the street widenings required in connection with the proposed connecting line of tramways between the terminus in London Road and the line in Park Road.

Malvern.—The Light Railway Commissioners have submitted to the B. of T. for confirmation an order authorising the construction of the funicular railway in the town.

Mansfield.—The T.C. has approved of plans submitted by the Tramway Co. for the extension of the tramways to the Mansfield Colliery and Crown Farm. The company will contribute £1,000 towards the cost of road widening.

Newcastle-on-Tyne.—The estimates of the Corporation Tramways Committee for the year ending March 31st, 1912, have just been prepared. These show a gross income of £212,350. The expenditure is put down at £119,350, leaving a gross surplus of £93,000, against a surplus of £91,050, for the year 1910-11. There is an estimated net surplus of £17,310, as compared with £15,950. It is added that the reserves and renewals fund will have to be drawn upon to the extent of about £6,000. The question of covering in the front ends of the cars as a protection to the drivers has been referred to a Sub-Committee.

Newport (Fife).—Following upon a lecture by Mr. Peter Fisher, manager of Dundee Corporation Tramways, on the railless system of electric traction, it was resolved unanimously to appoint a Committee to consider the question of the railless traction system, and the suitability of such a system for Newport and Wormit.

Paignton.—An intimation has been received from the National Electric Construction Co. to the effect that the amount of capital required for the laying of the tramways from Torquay to Paignton has been subscribed. The work will be commenced almost immediately. The standards in connection with the conversion of the system are at present being placed along the Torbay road.

Rochdale.—With reference to the inquiry from the Milnrow D.C. asking when the extension of the tramways from Firgrove to Newhey will be commenced, the Tramways Committee has decided to complete the through lines to Bacup as early as possible and then to proceed with the Milnrow extension. The Bacup section will probably be completed about June, and provided the scheme for widening and raising the road between Newbold Street and the Firgrove Bridge is then carried out, the Tramways Committee will be in a position to proceed with the construction of the track.

South Africa.—The Pretoria electric car system has made a good start. The takings for the week ending December 25th were £767, and for the week ending January 1st, £930. The takings for the week ending December 26th, 1909, were £307, and for the week ending January 2nd they were £311.

According to the *B. of T. Journal*, the Johannesburg city electrical engineer has invented an apparatus for showing the position of tramcars on the electric tramway system.

U.S.A.—The Chicago Association of Commerce is seeking a conference with the city authorities on the electrification of the railway terminals. It will be remembered that the city passed an ordnance requiring the railways to electrify all tracks within 7 miles of the City Hall before January 1st, 1913, and it seems possible that some definite action will now be taken.

Walsall.—The statement of accounts of the last year's working of the Corporation tramways shows that the traffic revenue amounted to £28,265 as against £26,789 in the previous year upon the same amount of mileage. The total income reached £29,004 against £27,490. The total working expenses were £16,491. The balance carried to the net revenue account reached £12,513 as against £11,519. Increased use has been made of the service during the year, the total number of passengers carried being 5,184,620 against 4,859,535 last year.

York.—The returns for the first complete year of the Corporation tramways show 412,499 car-miles run, 3,903,612 passengers carried, and £17,878 receipts. During the period the weekly car-mileage has increased from 3,250 to 9,700.

TELEGRAPH and TELEPHONE NOTES.

Communication with Trains.—The system of telephony between moving trains and signal boxes, &c., invented by Mr. H. V. Kramer, is to be experimentally installed on the Stratford-on-Avon and Midland Junction Railway. The apparatus consists mainly of a coil of wire wound round a railway coach, connected with the telephone instruments, and a wire laid alongside the track, connected with instruments at stations and signal boxes. Communication is effected by induction between the coil and the wire along the track. A buzzer can also be installed on each train, which automatically warns the engine driver of the presence of another train on the same line within a radius of five or 10 miles.

India.—The Indian Government has placed a contract with Marconi's Wireless Telegraph Co., Ltd., for the erection of wireless stations at Calcutta, Delhi, Allahabad and Simla; the stations will be employed mainly for military and official purposes, and will have a range of 600 miles each, except that at Simla, which will have a range of 300 miles. The cost will amount to £50,000. It is hoped that the work will be completed in time for the Coronation Durbar. This contract embodies the first extensive use of wireless telegraphy for inland communication. The Italian Government uses the Marconi system to a limited extent for the transmission of messages overland, and in connection with the Madeira-Mamore Railway, a Marconi station was erected at Manaos and another at Porto Velho, 540 miles distant. These stations have been at work for some time in a most satisfactory manner, in spite of the severe atmospheric conditions. Their efficient operation augurs well for the success of the enterprise upon which the Indian Government has now embarked.

South America.—The *B. of T. Journal* states that the Brazilian Government has authorised the expenditure of 300,000 milreis on a telegraph line between Goyaz and Boa Vista de Tocantins; and the Argentine Legation in London has been empowered to purchase telegraph material to the value of about £17,000.

Sweden and Norway.—The largest wireless station in Sweden—erected by the Telefunken Co., near Gothenburg—with a radius of action of 2,000 km., was to be opened during last month. It belongs to the State, and will serve mainly military purposes. A station of 1,000 km. radius is to be erected at Bergen.

Switzerland.—A *Daily Mail* correspondent says that the Swiss Government has authorised the establishment of a telephone wire through the St. Gothard Tunnel, enabling Berlin and Frankfort to communicate with Milan and Rome. But, though it passes through Switzerland, it must not be used by the Swiss.

Wireless Telegraphy.—Experiments are being carried out near Versailles by M. Maurice Farman in connection with the establishment of wireless telegraphic communication between a flying aeroplane and the earth. The aviator has already succeeded in transmitting messages from his machine to a point 10 miles away, and is about to extend the scope of his experiments by endeavouring to receive on, as well as transmit messages from, his machine.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—March 7th. Eleven sections of a branching multiple magneto lamp-signalling switchboard, for the P.M.G.'s Department in Victoria. See "Official Notices" December 16th.

March 14th.—Installation of wireless telegraphy at Thursday Island and Papua, for the P.M.G. of Australia. See "Official Notices" December 23rd.

April 18th.—One common-battery switchboard, for the P.M.G.'s Department in Western Australia. See "Official Notices" Dec. 23rd.

February 21st.—29 miles of telegraph cable, for P.M.G.'s Department, Victoria. See "Official Notices" January 6th.

February 28th.—One petrol-driven portable winch, for P.M.G.'s Department, Victoria. See "Official Notices" January 6th.

February 28th.—Motor-generator and accumulators, for the P.M.G.'s Department in Victoria. See "Official Notices" Jan. 13th.

March 7th.—10,000 telephone protectors, for the P.M.G.'s Department in Victoria. See "Official Notices" January 13th.

March 8th.—Measuring instruments for the P.M.G.'s Department in Queensland. See "Official Notices" January 20th.

April 4th.—10¾ miles of lead-covered cable, for the P.M.G.'s Department in Victoria. See "Official Notices" to-day.

June 14th.—Switchboard, common-battery, multiple, for the P.M.G.'s Department in South Australia. See "Official Notices" to-day.

June 14th.—Branching multiple magneto lamp-signalling switchboard, for the P.M.G.'s Department in Victoria. See "Official Notices" to-day.

Austria.—February 10th. The Austrian Ministry of Posts and Telegraphs, in Vienna, is inviting tenders for the supply of 120,000 metres of rubber-insulated wire, 400,000 metres of telegraph wire, 1,050,000 metres of wire cable, and 700,000 metres of lead and rubber-covered wire cable.

Barnes. — February 13th. Straight-tube water-tube boiler fitted for machine stoking, 600-750-KW. steam dynamo, surface condenser, motor-driven air and circulating pumps, river work and piping, for the U.D.C. See "Official Notices" Jan. 13th.

Bacup.—February 5th. High and low-tension cables and ducts, transformers and meters, for the Corporation. See "Official Notices" January 13th.

Birmingham.—February 13th. 1,700 tons of grooved steel girder tramway rails and 3,000 pairs of fishplates, for the T.C. A. Baker, general manager, 147, Corporation Street (returnable deposit, £2 2s.).

Blackburn.—February 13th. Stores, for the Corporation Electricity and Tramways Department. See "Official Notices" January 27th.

Bournemouth.—February 13th. Stores for a year, for the tramways department, for the T.C. Chas. W. Hill, general manager, Lansdowne (returnable deposit of 5s. for each of the 10 sections).

Brazil.—February 23rd. The Brazilian Ministry of Communications and Public Works in Rio de Janeiro is inviting tenders for the concession for the establishment and working of a telephone line between Rio de Janeiro and the capital of the State of St. Paul.

Cape Town.—March 1st. Tenders are invited for the installation of a system of ventilation, heating and cooling in the new Law Courts. See this column in our issue of December 30th.

Germany. — The municipal authorities of Pforzheim (Baden) have just invited tenders for the supply of 14 electrically equipped cars and 20 trailing cars for use on the electric tramway system in that town.

Glasgow.—February 6th. Electric light wiring and fitting for the first section of the new slaughterhouses in Hill Street, for the Corporation. Specifications from Mr. Lackie, city electrical engineer (deposit £1).

Gloucester. — February 21st. (*a*) One 750-KW. D.C. high-speed turbo-generator, with condensing plant; (*b*) one 150-KW. motor-generator, with starting gear; (*c*) switchgear for (*a*) and (*b*), for the City Electricity Department. See "Official Notices" to-day.

Halifax.—February 6th. Stores and materials for the Corporation Tramways and Electricity Departments. See "Official Notices" January 20th.

Hull.—February 16th. Electric light installation, fittings and fans, at Sidmouth Street School, for the Education Committee of the T.C.; J. H. Hirst, City Architect, Town Hall.

India.—February 6th. Combined H.T. and L.T. switchboards for new sub-stations, and switchboards for the Cossipore station, for the Calcutta Electric Supply Co., Ltd. See "Official Notices" January 13th.

Ipswich.— February 9th. Continuous-current high-pressure steam turbo-generator (600 or 750 KW.) with surface-condensing plant, for the Corporation. See "Official Notices" January 20th.

Kettering.—February 14th. Coal for a year, for the U.D.C. electricity works; W. A. Walker, Electrical Engineer.

Leeds.—February 16th and 21st. (*a*) 1,500 alternating-current watt-hour meters; (*b*) coal and stores, for the City Electric Lighting Department. See "Official Notices" January 20th.

Leek.—February 9th. Diesel engine and D.C. dynamo, for the U.D.C. See "Official Notices" January 20th.

London.—ISLINGTON.—February 23rd. Electrical and engineers' stores, for the B.C. See "Official Notices" January 13th.

BERMONDSEY.—February 20th. Stores, for the borough electricity and destructor works. See "Official Notices" to-day.

BATTERSEA.—February 14th. Stores for a year, for the B.C. Electricity Department. See "Official Notices" to-day.

HAMMERSMITH.—February 15th. Stores for a year, for the B.C. Electricity Department. See "Official Notices" to-day.

Portsmouth.—February 7th. Stores, &c., for a year for the T.C. electricity works. Electric light station, Gunwharf Road.

Roumania.—March 14th. With reference to the Tecuci notice given here last week, the upset price is put at 395,000 fr. (£15,800), and 5 per cent. of this amount will be required to qualify tenders. Tenders to "Monsieur le Maire, Conseil Municipal," Tecuci.

Russia.—The T.C. of Kiew invites tenders for the supply and installation of six electric clocks, with cable lines, insulators, &c. A deposit of 15,000 roubles is required. Particulars from the Concessions Department.—*Elektrotechnik und Maschinenbau.*

Salford.—February 13th. Stores for a year, for the Corporation Electricity Department. See "Official Notices" January 20th.

Spain.—The municipal authorities of Villanueva del Dugre (province of Cordoba) have lately invited tenders for the concession for the electric lighting of the town during a period of 10 years.

Stockton-on-Tees.—February 10th. Annual stores for the Corporation electricity works; Borough Electrical Engineer.

Turkey.—March 14th. Tenders for the erection of a hydro-electric station on the Adana River (Sciboun Tschaï), with the construction of the overhead transmission lines to and throughout the Adana district, are invited by the Ministère du Commerce et des Travaux Publics, Constantinople.—*Elektrotechnik und Maschinenbau.*

Turton.—February 20th. Bare copper overhead mains, poles, &c., for electric lighting in Bromley Cross area and Bradshaw Road, &c., for the U.D.C. See "Official Notices" January 20th.

Wakefield.—February 14th. 800-KW. steam alternator, for the Corporation Electricity Department. See "Official Notices" January 20th.

Walthamstow.—February 24th. Stores for a year, for the U.D.C. Electricity and Tramways Departments. See "Official Notices" to-day.

CLOSED.

Belgium.—Eight concerns—four German, three French and one Austrian—submitted tenders last week to the municipal authorities of Brussels for the supply of rubber-insulated cables for the low-tension transmission lines in the Belgian capital, the lowest being that of the Deutsche Kabelwerk Gesellschaft, of Rummelsburg, Berlin.

Brighton.—The T.C. Lighting Committee has accepted the tender of the British Westinghouse Electric and Manufacturing Co., Ltd., for motors for hiring out, for a year; and that of Messrs. Giepel & Co. for carbons, at £237. For the former there were 17 tenders, and for the latter 8, the highest being £481 10s.

Buckingham.—The B. of G. has accepted the tender of Messrs. Johnson & Phillips, Ltd., for the electric light installation at the workhouse, at £174.

Burnley.—The Corporation has accepted the tender of the Lancashire Dynamo and Motor Co., Ltd., for the supply of a motor booster, at £317.

Derby.—The T.C. has accepted the tender of the British Insulated and Helsby Cables, Ltd., for high-tension cable, at £450 10s.; and that of the Brush Electrical Engineering Co., Ltd., for three new tramcars, at £1,949.

Haslingden.—The Board of Guardians were notified on January 26th that Messrs. Simpson Bros., electricians, of Hapton, had intimated having made a mistake in their tender of £865 10s., recommended for acceptance out of 16 tenders for lighting Pike Law new infirmary and union buildings with electricity. Messrs. Simpson wished to amend their tender to £953, not having made sufficient provision for the cost of lamps. Five amended tenders were also submitted, and Messrs. Simpson were authorised to increase their tender by £48 8s. 9d., representing one-half the difference in the new and the old tenders. This act caused a long discussion, and, in stating that the Committee had tried to deal with the matter in a spirit of fairness and equity, Mr. Woolley agreed that to allow persons to amend their contracts would open the door to unpleasant experiences. Traders should have a full sense of responsibility, and to some extent stand by the mistakes they made.

Leyton.—The Essex Education Committee has accepted the tender of Mr. J. T. Halsey, of Stratford, for the installation of the electric light at the new County High School for Girls at Leyton, at £425.

London.—The Metropolitan Asylums Board has accepted the tender, on a schedule of prices, of Messrs. W. J. Fryer & Co. for the execution of works to be carried out in the laundries and workshops in order to comply with the Electricity Regulations under the Factory and Workshop Act, 1901. The estimate of the engineer-in-chief was £377.

L.C.C.—The Fire Brigade Committee received tenders as follows for the electric light wiring and fitting of the extension of the chief station of the Fire Brigade:—

Pinching & Walton .. .. (accepted)	£461
G. Weston & Sons, Ltd.	525
Foote & Milne, Ltd.	528
E. Newbald & Co.	545
Lund Bros. & Co.	621

For motors to provide power in the workshops at the chief station of the Fire Brigade the tenders were :—

Veritys, Ltd.	(accepted)	£159
Lancashire Dynamo and Motor Co., Ltd.		182
General Electric Co., Ltd...		193
Mavor & Coulson, Ltd.		195
Electromotors, Ltd.		197

The Highways Committee received tenders as follows for 500,000 stoneware cable-ducts for further tramway electrification :—

G. Skey & Co.	(not to specification)	£4,875
Stanley Bros.	(recommended)	4,487
H. R. Mansfield		4,731
Sutton & Co...		5,600
Doulton & Co., Ltd.		6,600

Manchester.—Messrs. A. & P. Steven have just secured an order for 24 hydraulic lifts for the new buildings of the Calico Printers' Association, Ltd., Manchester. The building will also be equipped with eight of the firm's "Silent Dustman" high-pressure vacuum cleaning machines.

Norway.—The A/S Tyssefaldene, who are completing their power plant at Tysse, Norway, have just placed a contract for the delivery of four 13,500-H.P. high-pressure turbines with the well-known turbine builders, Messrs. Escher, Wyss & Co., of Zurich, Switzerland.

Roumania.—The Roumanian Government has given to Siemens & Halske the contract to install a new telephone exchange at Bucharest for 14,000 connections, after a keen competition from European and American firms. The old exchange was constructed by an American firm.

Salford.—The T.C. has accepted the tender of W. Lucy and Co., Ltd., for two-way concentric cut-out boxes, at 6s. 9d. each.

Stoke-on-Trent.—The T.C. has accepted the following tenders for supplies to the electricity works :—

Siemens Bros. & Co., Ltd.—Portable sub-standard wattmeter and ammeter.
Electrical Co., Ltd.—Direct-current energy meters.
Electric Construction Co., Ltd.—Milking boosters.
Weston Electrical Instrument Co.—Portable current transformers.
Crompton & Co., Ltd.—Voltmeter switches.
Spagnoletti, Ltd.—Multiple-way switches.
London Electric Wire Co. & Smiths, Ltd.—Cotton-covered wire.

Walton-le-Dale.—The U.D.C. has accepted the tender of the Campbell Gas Engine Co., Ltd., for the supply of gas engines and pumps, at £2,337.

Wimbledon.—The U.D.C. has accepted the offer of the Postmaster-General to provide and maintain the Gamewell fire-alarm system connecting the central fire station with 19 call points in the borough for 10 years at an annual rental of £276 10s. The Council has further accepted the tender of the British Thomson-Houston Co., Ltd., for 116 low-tension switch-fuse panels for transformer sub-stations, at £484.

FORTHCOMING EVENTS.

Society of Engineers (Inc.).—Monday, February 6th. At 7.30 p.m. At the Institution of Electrical Engineers, Victoria Embankment, W.C. Presentation of premiums, and Presidential Address by Mr. F. G. Bloyd.

Institution of Electrical Engineers (Manchester Students' Section).—Tuesday, February 7th. At 7.30 p.m. At the Municipal School of Technology, Manchester. Paper on "Electric-Wave Telegraphy," by Messrs. A. K. Bentley and B. Hoyle.

Institution of Civil Engineers.—Wednesday, February 8th. Students' visit to the Victoria and Albert Museum (Heating and Ventilation System) and the Power Station, Imperial Institute.

Association of Engineers-in-Charge.—Wednesday, February 8th. At 8 p.m. At St. Bride's Institute, E.C. Paper on "Overtype Superheated Steam Engines," by Mr. W. J. Marshall.
Saturday, February 11th. At St. Bride's Institute. Social and dance.

Association of Mining Electrical Engineers (Newcastle Branch).—Wednesday, February 8th. At 7.30 p.m. At the Armstrong College, Newcastle. Discussion on "Data or Specification, in relation to the Design of Induction Motors for Driving Haulages, &c.," to be opened by Mr. J. P. Simpson; and paper on "Electricity in New South Wales Collieries," by Mr. E. K. Scott.

Institution of Electrical Engineers (Birmingham Local Section).—Wednesday, February 8th. At 7.30 p.m. At the University, Birmingham. Paper on "The Electrical Undertaking of the Birmingham, Tame and Rea District Drainage Board," by Mr. L. F. Mountfort.

Institution of Electrical Engineers (London).—Thursday, February 9th. At 8 p.m. Adjourned discussion on papers on "Long-Distance Transmission of Electrical Energy," by Mr. W. T. Taylor; and "Extra-High-Pressure Transmission Lines," by Messrs. R. Borlase Matthews and C. T. Wilkinson.

Institution of Electrical Engineers (Dublin Section).—Thursday, February 9th. At 8 p.m. Meeting at the Royal College of Science, Dublin.

Institution of Electrical Engineers (Yorkshire Local Section).—Friday, February 10th. At 6.30 p.m. At the Hotel Metropole, Leeds. Annual dinner.

Manchester Association of Engineers.—Friday, February 10th. 55th anniversary dinner.

Institution of Electrical Engineers (Glasgow Local Section).—Saturday, February 11th. At the Grosvenor, Glasgow. Annual smoking concert.

Junior Institution of Engineers.—Saturday, February 11th. At 6.30 p.m. At the Hotel Cecil. Annual dinner.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

THE following orders are issued :—

Commanding Officer—COL. H. M. LEAF.

Monday, February 6th.—"A" Company. Technical drill, 7 to 10 p.m.
Tuesday, February 7th.—"B" Company. Technical drill, 7 to 10 p.m.
Thursday, February 9th.—"C" Company. Technical drill, 7 to 10 p.m.
Friday, February 10th.—"D" Company. Technical drill, 7 to 10 p.m.

(Signed) P. H. CAMPBELL, Capt. R.E., Adjutant.

NOTES.

Municipal Electrical Salaries.—Fulham Electricity Committee has decided in favour of increasing the commencing salary of the junior engineers from 30s. to 35s. per week, rising to 40s. The present normal staff of assistant engineers is to be increased by the appointment of a junior charge engineer, who is to have a status between that of the junior engineers and the charge engineers, and whose salary is to commence at 45s. per week, rising to £3.

Salford T.C. has fixed the scale of salaries for the collectors of electricity rents, &c., at a minimum of £150 per annum, rising by £10 at intervals of two years to a maximum of £220 per annum for the chief collector, and of £200 per annum for each of the other collectors. The Electricity Committee has decided in favour of raising the salary of the mains engineer from £180 to £200 per annum, and the salary of the first assistant engineer on mains from £140 to £150 per annum. The Tramways Committee has fixed the minimum salary of the general manager of the tramways at £450 per annum, rising by annual increments of £25 to a maximum of £650.

Coronation Illuminations.—The Associated Municipal Electrical Engineers (Greater London) have passed the following recommendation :—"That this Association recommend that the charge for current for Coronation illumination be on the basis of 1d. per unit, with the minimum connecting and disconnecting fee of 5s., and where the existing service is insufficient, the cost of additional service."

Staff Dinner.—The annual works staff dinner of Messrs. Crompton & Co., Ltd., was held on Saturday last, January 28th, at the Club House, Arc Works, Chelmsford. Just over 100 persons, including Mr. Hew Stevenson, the general manager of the company, and some 12 members of the London office staff, were present. Mr. A. J. Hodgson, the works manager, was in the chair, with Messrs. S. C. Macfarlane and C. Crompton, respectively managers of the main and the lamp shops, as vice-chairmen. The menu was of the humorous order, being drawn up in the form of a tender, in one column appearing items "as specified," such as Liquid Starter, Negative Rooster, What-hour-meet-her, Exciter, C.M.B. Balancer, Temperature 200° F., &c., while in another column appeared the alternatives "as offered," being respectively soup, turkey, tart, whiskey, soda water, smokes, &c. The toast of "The Firm," coupled with the name of the general manager, was proposed by Mr. P. G. Cheverton, and the general manager, in his reply, said that although competition had been very keen in the electrical trade, he was sure that had it not been so, electricity would not have made the vast strides it had done in so short a time, nor would the methods of manufacture have been improved so quickly, to back up which he mentioned that the works cost of machines were now something less than a fourth of what they were about 20 years ago. He felt sure that although competition was still just as keen as ever it had been, the trade was improving, if somewhat slowly. He also stated that the temperature rise of 200° F. mentioned on the menu reminded him of the time when, as chief of the test room staff of a certain firm, he had tested two machines made to the order of an eastern potentate, and the temperature rise on them was such that there had been no thermometer in the works with a long enough scale to register it, and on the man responsible being sent for to decide what should be done with the machines, that worthy, after glancing at them, had ordered, "Paint the 'D' things white and let them go," and although the eastern potentate to whom they were sent was, if half the reports about him were true, very "hot stuff" himself, yet the machines had evidently been a bit too warm even for him, for the said firm was after about a quarter of a century still waiting for the repeat order. The other toasts honoured in addition to that of "The King," were "Chairman and Vice-Chairmen," "Foreign Representatives," "Dinner Committee and Entertainers," in the excellent smoking concert which followed.

Will.—The late Mr. G. H. Brougham Glasier, who was vice-chairman of the Charing Cross, West End and City Electricity Supply Corporation, Ltd., and was also connected with the Suppliers Construction Co., Ltd., and the Kent Electric Power Co., left £184,851 gross, and £46,177 net personalty

An Austrian Electrical Transaction.—It is now a few years since a new departure in banking on the European continent was recorded in this journal by the announcement that the Union Bank of Vienna had decided to open an electrical department. The electrical interests of this important bank date back, on the one hand, to the liquidation of the Union Electricity Co., which was amalgamated with the Vienna departments of the A.E.G., under the title of the Austrian A.E.G.-Union Co., and, on the other, to the liquidation of the International Electricity Co., which was absorbed by the Union Bank after the municipalisation of its Vienna electricity works. In addition to the management of electrical undertakings of the tramway and lighting character, the bank's electrical department devoted itself to the study of schemes for electric railways, although it was thought that the department would have to give way in the matter to the electrical manufacturers in the event of the projects coming forward for realisation. However this may be, it is now announced that the bank has just disposed of most of its undertakings, as represented by the electricity works of Bielitz and Budweis, together with a tramway, the Pols Works, the shares of the Wels Electricity Works, the Brunn tramways and some other similar enterprises. The purchaser is the United Electricity Co., which has become a trust company by reason of the transfer of its manufacturing works to the Austrian Brown-Boveri Co., in which it has a shareholding of £83,000, whilst the former is also largely interested in the United Glow Lamp and Electricity Co. and the United Electricity and Machine Works Co., of Budapest. In the circumstances, it is of importance for the United Electricity Co. to extend its scope, in order to provide customers for the manufacturing works with which it is closely associated, and the acquisition of the greatest portion of the undertakings held by the Union Bank has afforded such an opportunity, the share and loan capital of the United Co. being increased by £416,000 for this purpose. It is understood that, notwithstanding the considerable transfer of property, the Union Bank does not yet intend to discontinue its electrical department, but even proposes to consider new business. At the same time, the bank has joined the United Co.'s financial group, which has hitherto been composed of the Lower Austrian Discount Co. and the Hungarian Commercial Bank of Pesth

Tungsten Lamps with Drawn-Wire Filaments.—Referring to the "Zokul" lamps, Mr. C. W. Bender, of the National Electric Lamp Association of Cleveland, recently stated that these have tungsten filaments of drawn wire, and are now available in the 15, 25, 30 and 40-watt sizes, designed to burn on 30-volt and 60-volt circuits, principally for train lighting. The 110-volt, 220-volt and series Kokul lamps are not quite ready for the market, although it is expected that they will be in a few months. Experience with these drawn-wire lamps on low-voltage circuits has been very satisfactory, according to Mr. Bender. The filaments are about five times as strong as squirted tungsten filaments; they have a life of 1,500 hours or more. In the experimental 110-volt lamps of this type it is found that after burning 1,500 hours nearly the entire length of the filament is ductile. However, small sections of the filament are found to be still fragile, and when the entire filament is made as strong as nearly all of it is now the commercial Zokul lamp will be ready for the market.—*Electrical World.*

Turbo-Dynamos for Train Lighting.—Train lighting in the United States has developed in a different direction to that which it has followed here, thanks, no doubt, to the different conditions—the very long runs, during which no change takes place in the make-up of the train, and so on. Thus it is quite usual to install a steam dynamo on the locomotive or in a "baggage car," to light the whole train, without using a battery. The *Electrical World* states that "at the present time, when the railways are making every effort to ensure the greatest degree of safety to their passengers, these sets are meeting with favour, as their use eliminates all danger from fire or explosion due to the leakage of illuminating gas in case of an accident." The sets referred to are small Curtis turbines, coupled to dynamos, which require practically no attention, and provide not only for lighting, but also for heating and cooking and for electric toilet articles in drawing-room and sleeping cars. Over 300 of these sets are now in use on steam railways.

Tunbridge Wells Electricity Department.—The seventh annual staff dinner of this department was held on Wednesday, January 25th, Mr. J. W. Beauchamp, resident electrical engineer, presiding. Among those present were several members of the Council, and Mr. Horace Boot, the consulting engineer. The chairman proposed the toast "The Chairman and Members of the Lighting Committee," and referred to the cordial character of the relations between the Committee and the staff. Councillor Edwards responded. Mr. W. H. Hayden proposed the health of Mr. Boot, and on behalf of the staff and employés presented him with an illuminated address, marking their appreciation of his 15 years' service in connection with the undertaking. Mr. Boot responded in an interesting speech. "The Staff" was proposed by Alderman Carpenter. and Mr. J. Bemrose replied. Councillor Dennis, in toasting "The Visitors," expressed pleasure at the cordial relations which existed between the contractors and the undertaking, and at the good feeling which continued between them under the management of Mr. Beauchamp. Mr. J. P. Strange, who responded, also referred to the co-operation of the contractors and the department. Mr. Boot presented each of the men with a portrait of himself.

Falkirk Electrical Appointment.—A short leet of 12 has been selected out of the 140 applications for the post of borough electrical engineer at Falkirk.

West Ham Corporation Electricity Supply Dinner.—The fifth annual dinner of the West Ham Electrical Department was held in the Crown Room of the Holborn Restaurant on Thursday, January 26th. There was a very good attendance, covers being laid for about 150 guests. Mr. H. H. Couzens, chief of the department, presided, and after the usual loyal toast, Mr. Fletcher, proposing "The Mayor and Corporation of West Ham," said that when he proposed a similar health two years ago, he dared to predict that the action of the West Ham Electrical Committee would be the means of increasing the number of manufacturers in the borough. This prediction had very largely come to pass, and he felt sure that many other firms would follow their example. He called to their minds the fact that on February 1st the new "Dreadnought" was to be launched, and it was gratifying to know that the West Ham Corporation had contributed in no small degree to the very quick building which had been accomplished by the Thames Ironworks. The Corporation had supplied 400 KW., and he hoped that number would be increased in the future and the number of "Dreadnoughts" as well. Although he came from the banks of the Tyne, he was not one of those who believed that the people of Tyneside were the only ones who could build "Dreadnoughts," and he hoped that, in 1911 and in years to come, many more would be built in the borough. This toast was coupled with the name of the Deputy Mayor (Councillor Davis), who, in reply, said that, as far as the Corporation were concerned, they would one and all do their utmost to help the department, and would be very pleased to see Mr. Fletcher's hopes fulfilled, and he believed the chairman could supply with power as many as would come. The Corporation would do their part, and looked to the companies to do theirs. They could bring as many factories as they liked, and the Corporation would light them without burning them down. Councillor Croot, in proposing the toast of "The Electricity Department," expressed the great pleasure it gave him in doing so. He was an advocate of municipal enterprise, and, as chairman of the Electrical Committee, he wanted that department to be a greater success than it had been in the past; in his opinion there was a great future before them. When the *Thunderer* was launched they would lose a good customer, but they hoped to get another order from the Government. The toast met with a very hearty reception, and, in reply, Mr. Couzens thanked them saying that it was customary for the chairman to express a few views on the undertaking, but he hesitated to say anything specially good about it for fear something might happen; however, he would give them one or two figures which might be of interest. For the present year, during the nine months ending December they had sold 19½ million units, an increase of three millions on the corresponding period of the previous year. The increases for lighting and power purposes were 12 and 30 per cent. respectively, and the financial position showed a very substantial improvement, approximately £4,000. There were some heavy items of extraordinary expenditure, and they were now having to buy meters out of revenue, instead of, as in the past, out of capital. The sales department was very satisfactory; for the nine months the sales had been £10,500, an increase of £700, and the number of meters attached to the circuit was 11,200, increase of 1,700. The sales department would, however, be hampered for the next two or three years, by reason of the capital charges for the first time having been placed upon that department. As the result of the decision in the recent Attorney-General's action, it was necessary to apply to the Local Government Board to raise what he thought might be called trading capital; the Board granted a loan, but they gave only three years for the repayment. That was an absurd period, because the sales department was going to last much longer than that, and it meant £2,500 a year on that item alone. When this was taken into consideration, the results of the department would not be thought bad. He read a list of some of the chief new manufactories which had opened in West Ham, and, in conclusion, voiced the appreciation of the staff of the way the Council had helped the electricity department, and did not, as sometimes happens, use their trading departments, and more particularly the electrical, as a butt for party political purposes. He could assure the Corporation that the staff were thoroughly loyal to the interests of the department, and would do all in their power to make it a bigger success. The toast of "The Visitors" was proposed by Mr. Farndon, and replied to by Mr. Baldwin, and altogether an enjoyable evening was ably engineered by Messrs. Johnson and Smith, secretary and treasurer of the Dinner Committee.

Steel versus Cast-iron Magnets.—Referring to the article on cast-iron permanent magnets in our last issue, Messrs. W. F. Dennis & Co., of 49, Queen Victoria Street, have sent us particulars of the steel magnets manufactured by Messrs. Heinrich Remy, G.m.b.H., of Hagen, Westphalia, for whom they are sole agents in the United Kingdom. Messrs. Remy make their own tungsten crucible steel, and are thus enabled to ensure the high quality of their products, the constitution of the steel being, of course, a matter of prime importance in this connection. Comparing the results obtained from their steel magnets with those shown in the article above-mentioned, Messrs. Dennis give the following figures:—

	Coercivity.	Permanence.
Remy steel magnets	72·5	11,110
Cast-iron magnets	38	2,800

The Remy magnets are made in any shape desired, the firm making a speciality of working to customers' drawings.

Platinum.—Reuter reports from St. Petersburg that the Minister of Commerce has introduced a Bill prohibiting the export of unrefined platinum.

(*Continued on page* 187.)

THE BRIMSDOWN METAL-FILAMENT LAMP WORKS.

Now that the metal-filament lamp has—shall we say—come into its own, and is being appreciated on its merits, not only as an economiser, if need be, of quarterly accounts by the consumer, but also as one of the most effective weapons for the future expansion of central station revenue, one is justified in anticipating that strenuous efforts will be made to supply the home market, at least, with home-made products. Considerable developments have already been made along these lines, and among the several new lamp factories which have recently come into being, what is possibly the most recent example of a modernly-constructed and equipped lamp factory—the Brimsdown Works of the Imperial Lamp Works (Brimsdown), Ltd.—was recently thrown open for inspection by the technical Press, the inspection being more than usually interesting, as the visitors were privileged to view all the essential processes of metallic-filament making, in addition to the later stages of the bulb work, with which, of course, many are familiar.

The works, fig. 5, which are quite new, occupy a considerable area, some 4 acres or more, and are constructed on the modern one-floor principle, with roof lighting. Separate buildings house the filament making and so-called lamp-making departments, and the lay out of the works provides for systematic extension when required. A sub-station is provided on the site, in which 5,000 volts, three-phase, 50-cycle energy, supplied by the North Metropolitan Power Co., is transformed down for use in the works, which are electrically driven throughout.

The first and most interesting process shown at Brimsdown was that of filament making, in which, in the chemical department, the tungsten powder is reduced to an exceedingly fine state by lengthy grinding, and chemically treated in order to convert it to colloidal form. To the latter, as a binding material, water is added, the thorough intermixture being secured by rotating it in glass containers in special machines, shown in fig. 2. This mixture is further treated, the surplus water driven off, and in plastic form, it is calendered, emerging as thin gelatine-like strips, which are rolled up by hand and inserted in steel cartridges.

The next process is that of squirting the filament; the cartridges are inserted in either hand or hydraulic presses, and their contents forced through diamond dies; thin hair-like filaments are extruded and fall on to paper trays to which a to-and-fro motion is given by the operator, with a view to laying the filaments in some sort of order. These long filaments are then cut up into shorter lengths, each suitable for one filament loop, and sorted by girls, being subsequently laid in small

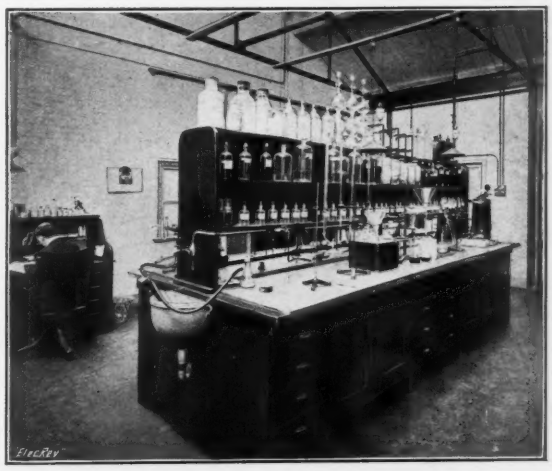


Fig. 1.—The Chemical Laboratory, Brimsdown Lamp Works.

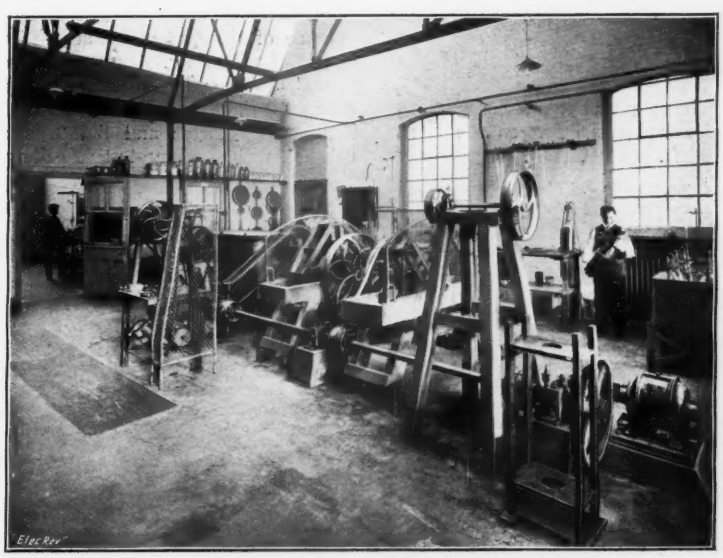


Fig. 2.—Mixing Machinery in the Chemical Department.

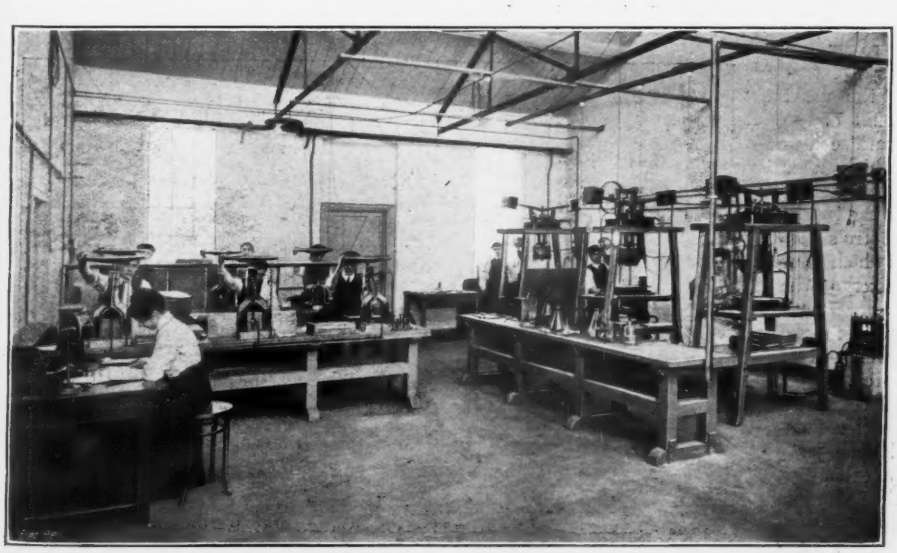


Fig. 3.—Filament Squirting, showing the Power and Hand Presses.

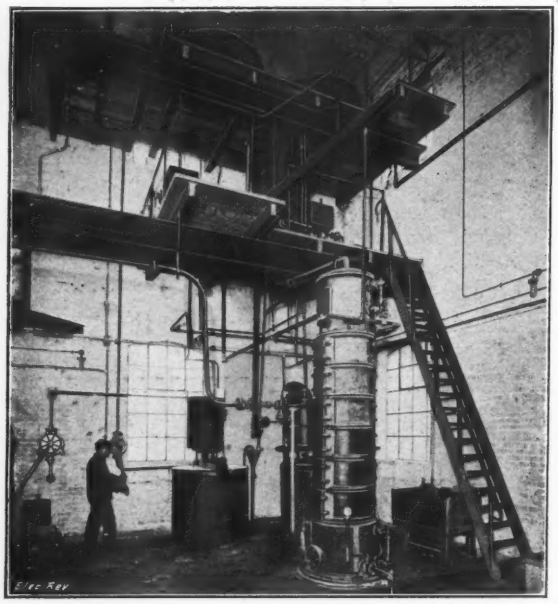


Fig. 4.—The Ammonia Plant.

trays and baked in gas-heated ovens to get rid of the remaining moisture.

Our illustration, fig. 3, shows a portion of the filament squirting department, the power presses being on the right and the hand presses on the left.

current then switched off. The jar is subsequently exhausted by connecting it to the vacuum system of the works, and the filaments removed, pending the repetition of the process. The ammonia plant for the works is shown in fig. 4; ammonia compressors are installed in the forming department, and the gas is led to reservoirs under each bench.

The automatic switches and voltage regulators are fixed under the bench and operated by mechanical drives from a slow speed shaft geared to a ¼-H.P. motor at the end of each bench.

We understand that this ingenious and highly efficient bench equipment, as well as a large portion of the plant installed elsewhere in the works, has been developed by the company's engineers, to whom great credit is due. The process which we have just described eliminates all extraneous material, leaving filaments of pure tungsten, of considerable strength and such flexibility that a high-voltage filament can be twisted and untwisted round the finger. Each class of filament is then cut separately to size on an adjustable gauge, and, as a final precaution, each one is weighed in a magnetic balance, which accurately registers to one-tenth of a milligramme.

The filaments are then ready for mounting, an operation which is carried out in the separate building housing the lamp department, and comprises processes which will be largely familiar to our readers, being essentially the same as are adopted in other factories which we have described.

Some of these processes are shown in the accompanying views, of which fig. 6 represents some of the sealing-in machines driven by miniature motors on the floor; fig. 7 shows the ingenious little electrical welders for joining-up the filaments, &c.; and fig. 8 is a view of the capping benches, with the lamp-testing gallery in the background.

Fig. 5.—General View of the Imperial Lamp Works, Brimsdown: the building on the left is the Old Works.

In the next stage of the process, the filaments are "formed"—an operation which attracted more than the usual amount of attention on account of the ingenious and largely automatic equipment of the benches on which it is carried out. At the present time eight benches are in use, each having 10 girl operators; each operator controls two glass bell jars, under one of which four filaments automatically undergo the forming process while the operator adjusts the unformed filaments in the neighbouring jar. The extremities of each of the four filaments are fixed in terminal clamps, small weights being suspended from the lower portion of the filaments to form the loops; the bell jar is next lowered and partially exhausted, ammonia vapour being then let in. Current is switched on to each filament in turn, the pressure being automatically increased until it reaches about 50 per cent. above the normal voltage, and the

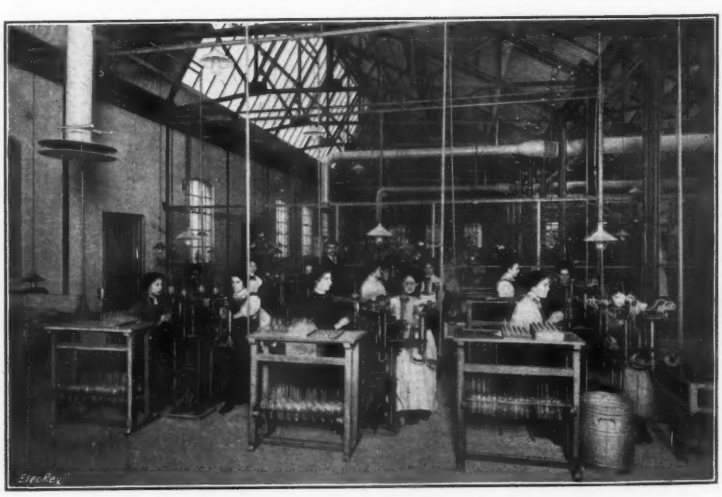


Fig. 6.—Electrically Driven Sealing-in Machines, Lamp Department

The operations comprise foot making, for which purpose glass tubing is cut into suitable lengths, and one end of each length flanged under the blow-pipe, either in automatic machinery or by hand; the leading-in wires are then inserted in the tubes, and "sealed in" by special machines, five of which are provided. The central stems are produced from glass rod, the radial nickel supports for the filament, top and bottom, are attached by the blow-pipe, and the bottom ones bent over and cut to length; the filaments are then hung round the supports, the loose ends being pasted—with tungsten paste—to the extremities of the supports nearest the foot, and finally electrically welded — a delicate operation carried out under a bell jar previously filled with hydrogen.

The foot, stem and complete filament are then ready for insertion and sealing in the bulb, the upper portion of which is fused to the foot in a sealing machine.

The bulbs have previously had exhaust tubes attached at the pip ends, and in the next process, *i.e.*, that of finally exhausting the lamps, they are preliminarily heated, and attached by means of the tubes to a suitable vacuum system, the tubes fused (*i.e.*, nearly closed) by means of the blowpipe flame, the filament brought to a state of incandescence and the bulbs finally sealed off by means of the blowpipe.

Fig. 7.—Filament Welding Machines, Lamp Department.

Fig. 8.—Capping Benches and Lamp Testing Gallery.

The exhausting benches have been specially equipped, each operator being provided with a small oven, blow pipe, and electrical and vacuum connections—the latter enabling the bulbs to be initially coupled to electrically-driven vacuum pumps and afterwards connected to Gaede pumps for the final stages of exhaustion.

The lamps are now practically complete, it only remaining to test and cap them.

Every lamp turned out by the firm is run for five hours, being hung by means of the leading-in wires from the terminals of special test frames, and carefully inspected for any apparent faults. Ten lamps from each batch are run for 700 hours, and their peculiarities carefully logged in a book kept for the purpose.

We understand that rarely less than 93 or 94 per cent. of the lamps so tested outlasts the test period, while, on occasion, as high as 97 per cent. has been reached.

After the trial run, the caps are cemented on, the leading-in wires threaded through and soldered to the contact strips in the top of the caps, and the bulbs washed in weak acid —operations which are shown in fig. 8. The completed lamps finally pass through one or other of the photometer rooms, where their candle-power, amperage and pressure are definitely ascertained and subsequently marked in cypher, together with the date, on each lamp, before passing to the stores.

One of the photometers, thrown open for inspection, was of the bar type, operated by four girls—two for fixing and replacing the lamps to be tested in a revolving carrier; one for taking candle-power readings, and a fourth for taking electrical readings and booking the results generally. We understand that some 2,000 lamps a day can be tested on this photometer.

A large proportion of the machinery is of the automatic or partly automatic type, and in nearly all cases the machines are independently driven by small motors, which, however, are so small as to be scarcely noticeable in our views.

Systematic inspection prevails throughout the factory, the product at each stage of the work being checked by skilled operatives, who ensure that the recognised standard is maintained, and if possible improved on.

In fact, every effort has been made to ensure that Brimsdown lamps shall reach the highest standard. The conditions under which the 500 employés—mostly girls—work, are far above the average; the works are well lighted

and supplied with air from a Stott ventilating and air filtering plant, while for the convenience of the "diners in," a hall to seat about 300, with cooking ranges and attendants to cook meals, is no small attraction.

We understand that some 4,000 lamps per day are now being made, but provision has been made in the present works for extending the output to 10,000 in the near future.

In conclusion, our thanks are due to Mr. Ernst Sharrer, the managing director of the company, and to Mr. J. G. Chiswell, the sales manager, for the attention they bestowed on ourselves, amongst others, on the occasion of our visit to the works.

MIXED-PRESSURE TURBO-ALTERNATOR SETS.

THE accompanying views are of 500-KW. mixed-pressure steam turbines supplied by Messrs. Dick, Kerr & Co. to a colliery in Scotland.

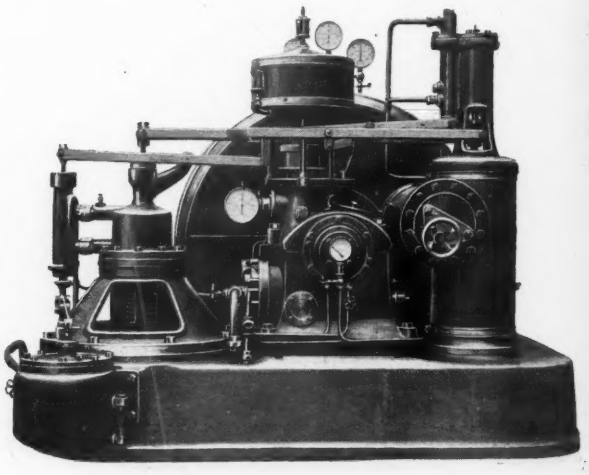
The turbines, which are of the impulse type, and built on the Bergmann system, are designed to give 500 KW. with exhaust steam having a pressure of 16 lb. per sq. in. absolute, or with dry saturated live steam of 90 lb. per sq. in., or with a combination of both pressures, and to give their full output when working condensing with a vacuum of 27·5 in. and a bar. pressure of 30 in.

Under these conditions an overload of 25 per cent. for two hours, and 100 per cent. for five minutes is provided for.

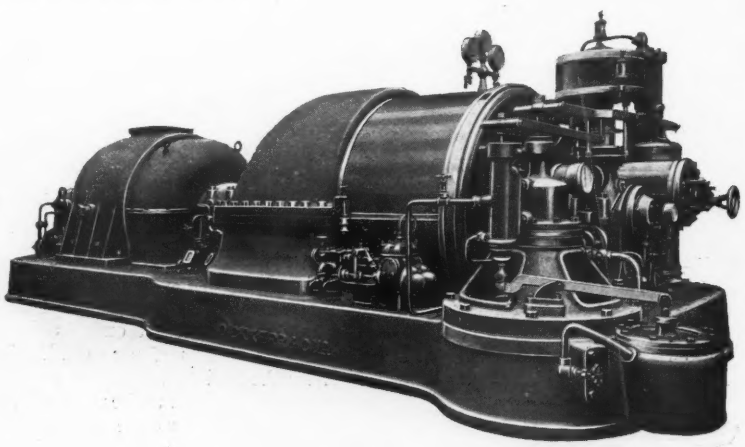
Each turbine is mounted on a combination base, and is complete with two bearings, and is direct connected to its alternator through a flexible coupling.

Each turbine is provided with H.P. and L.P. main stop valves, H.P. steam separator, governor, steam and oil gauge pipes, an emergency device for stopping the turbine when normal speed is exceeded by 10 per cent. (this safety device closing the main turbine stop valve, and not the throttle valve), and oil receptacle with filter, direct connected oil pump, separate steam oil pump for flooding the bearings before starting up, speed adjusting device, &c.

The governor is extremely sensitive, and allows steam to enter the turbine in a continuous and steady flow, whether running on mixed pressure or on live steam, or when changing from one to the other.



GOVERNOR GEAR, DICK, KERR (BERGMANN) TURBINE.



MIXED PRESSURE DICK, KERR TURBINE AND ALTERNATOR.

The following are the principal features of the turbo-alternators in this combination:—They are designed to give 625 K.V.A. (500 KW. at 80 per cent. power factor) at 3,000 volts, and 50 cycles when running at 3,000 R.P.M.

The overload conditions are the same as for the turbines, and the temperature rise does not exceed 70° F. above an air temperature of 77° F. after an eight hours' run at full load.

INTERIOR OF THE NEW SHOWROOM, BECKENHAM ELECTRICITY DEPARTMENT.

A NEW ELECTRICAL SHOWROOM.

WE recently had the pleasure of visiting the new permanent showroom and exhibition which has been opened by the Beckenham Electricity Department, under the supervision of Mr. J. E. Tapper, the resident engineer.

The premises occupy a prominent corner position in the centre of the best shopping and residential part of the district. The exterior is finished in white enamel, with green facias, on which white opal letters are fixed, these being illuminated at night. An electrically-lighted hanging sign is mounted over the doorway, and a brilliant general illumination is provided by a number of Grevener flame arc lamps.

The front room of the premises contains a great variety of lighting and heating accessories. There is a representative selection of wall fittings, pendants and floor stands, all of which are wired and fitted with lamps, so that the visitor may see and judge them in actual use. On a stand in the centre a number of accessories as electric flat irons, shaving water heaters, kettles, &c., are displayed, while arranged along the walls may be seen radiators and convectors of different patterns. Prominently exhibited in one of the windows are samples of electrically cooked food. The power exhibit comprises, among other things, motor-driven fans, a motor-driven Singer sewing machine, and an electrically operated vacuum cleaner. A laundress from a local

cleaning works was engaged, during the opening days, in demonstrating the advantages of the electric iron. A noticeable feature in the showroom is the absence of overcrowding, in spite of the somewhat limited size of the premises.

Two rooms at the rear have been fitted up as a dining room and kitchen respectively, and are so arranged that a lady, seated in comfort in the dining room, can watch the preparation of a meal in the kitchen. The latter apartment is furnished with a "Tricity" duplex cooker with extension plate, portable oven, grill, water urn, and a number of other vessels, an "Eclipse" cooker, a "Fuller" electric geyser, a "Therol" water heater, and a number of other things necessary to complete a kitchen outfit. Demonstrations in electric cooking are given from time to time. These, we are informed, will be a permanent feature of the showroom.

The dining-room is very tastefully furnished and effectively lighted by a bowl ceiling fitting and four two-light candle brackets, an electric radiator in the fireplace providing a genial warmth.

The whole scheme is excellently carried out, and we have no doubt that it will materially improve the load factor of the undertaking. The Council charges a specially low rate for energy absorbed for heating, cooking and motive power.

It is of interest to note that the Council, in opening its new showroom, is co-operating with the local electrical contractors, who will benefit from every sale effected. The difference between the price paid by a customer and the trade price will be handed over to one of the three local contractors in rotation, a small percentage being deducted to assist in paying the establishment charges of the showroom. This arrangement obviates all chance of friction between the electric light undertaking and local firms.

The illuminated facias and sign were supplied by the General Electric Co., Ltd. The electric light fittings in the showroom were provided by Messrs. Falk, Stadelmann & Co., Ltd., and the cooking and heating apparatus jointly by the Berry Construction Co., Ltd. ("Tricity"), and by the Electric and Ordnance Accessories Co., Ltd. ("Eclipse"). Samples of the fittings supplied under the Council's free-wiring scheme are displayed by the three local contractors recognised by the Council—Messrs. Buchanan & Curwen, H. W. Tyler, and Oscar Jones & Co.

CONSULTING ENGINEERS, LTD.

Our attention has been called to an editorial article—or is it an advertisement?—in the current issue of the *Municipal Journal*, entitled "Electrical Power Users." The article deals with a new Association which has just been formed under the title "The Electrical Power Users' Association," which, according to the *Municipal Journal*, "has struck an original note, which has not had its equal since the inception of the Municipal Mutual Insurance Scheme." Particulars of the registration of the Association will be found on page 149 of our last issue.

Briefly, the objects of the Association are to undertake electrical consulting work and the insurance of electrical plant and machinery, both of which are pretty thoroughly covered by existing insurance companies. We, therefore, fail entirely to recognise the note of originality.

We have often heard consulting engineers complain of the unfair competition of these insurance companies, and letters have frequently appeared in our "Correspondence" columns condemning the practice. According to the code of professional etiquette adopted by the Association of Consulting Engineers—which, by the way, has done us the honour of adopting our recommendations as to the qualifications for membership—it is an unpardonable offence for a consulting engineer to advertise for work in any shape or form, but he need only convert himself into a limited company or become the engineer to a machinery insurance company, when he may advertise to his heart's content, apparently without any loss of dignity.

The originator of "The Electrical Power Users' Association" is a Mr. Oliver Huxley, B.Sc., consulting engineer, who, according to the inspired article in the *Municipal Journal*, "has, since his severance from municipal engineering some years ago, in his capacity of consulting engineer, specialised in the installation of large electrical power plant for factories, steel works and collieries," &c.

Mr. Oliver Huxley, B.Sc., must surely have been hiding his light under a bushel, as we do not remember to have heard of him in the capacity described. The other gentlemen associated with the venture are the Right Hon. Earl Russell, Sir Richard Temple, Bart., Col. W. C. Dickenson, and Mr. J. T. Scriven, none of whom, according to our distinguished and esteemed contemporary, "has been connected in any way before with municipal life, but their interest will doubtless ere long extend to other branches of municipal work." Does our memory play us false, when we recall Earl Russell's connection with the London County Council? Is not that municipal life? However, we are at a loss to understand the inner meaning of this paragraph, as the Association appears to have nothing whatever to do with municipal work in any shape or form, its activities being confined, so far as we can gather from the article, to "private plant installations."

We observe that an issue of debentures is likely to be made, though, perhaps, not a public one, "as the response is likely to be very gratifying to the directors and originators of the Association—Messrs. Huxley and Dilloway." These debentures, it is interesting to note, may be redeemed after two years "by the payment of 25 per cent. interest"; this presumably means that if the venture is a success it will revert into the hands of "the subscribers and members, who will have the sole control." But if it is not a success, we suppose that those who make the "gratifying response" and become debenture-holders will have to put up with—well, something else? The writer of this article, or advertisement, which relates to *power-users*, says that there are over half-a-million electrical installations in the United Kingdom. Really, and how long has that been? 500,000 works, factories, shops, &c., all using electricity to such an extent as to come within the Association's purview?

The specific objects according to the Articles of Association are, in addition to insurance, "To test and examine periodically . . . electrical and other machinery. To issue reports of such visits and examinations. To advise generally as consulting engineers, upon the electrical equipment. . . . To advise subscribers as to the installation of new machinery," &c.

As stated already, we fail entirely to recognise the note of marked originality, and we should like to ask the Association of Consulting Engineers how it regards this kind of thing, because it seems most unfair that a recognised consulting engineer should be hedged round with all kinds of restrictions whilst such an association as the one described cheerfully, and without any qualms, takes the bread out of his mouth.

NOTES.

(Continued from page 182.)

Western Valleys of Monmouthshire Railless Traction Bill.—On Monday the Bill promoted for the construction of tramways on the railless traction principle in the Western Valleys of Monmouthshire by a company to be incorporated with a capital of £60,000, came before the Examiners—Messrs. Jeune and Campion—for proofs as to compliance with Standing Orders. The Nantyglo and Blaino and the Abertillery Urban District Councils had lodged memorials alleging "non-compliance." Formal evidence having been given, the Examiners found that the promoters had failed to comply with Standing Orders, in as much as they had not obtained the consents of the road and local authorities. The Bill will accordingly come before the Committee on Standing Orders, who will decide whether it shall be allowed to proceed.

A Remarkable Cable.—Our contemporary, the *Journal of Electricity*, states that a cable manufactured at the Pittsburg, Pa., factory of the Standard Underground Cable Co. in 1886 was installed in the city of Philadelphia in May, 1886. The cable was manufactured and sold for 600 volts working pressure and was operated at that pressure for several years, when the working voltage was increased to 2,000, at which voltage the cable was operated for several years and until a change in the system necessitated taking it out of service in September, 1910, after the cable had been in continuous service for 24 years and four months. The copper, insulation (fibre saturated with Ozite compound), lead, and outer covering of saturated braid, are all in excellent condition and appear to be practically as good now as the day the cable was first placed in service over 24 years ago.

Appointments Vacant.—Junior charge engineer for the Darlington Corporation Electricity Works (£78); junior assistant engineers for the Newcastle-on-Tyne Electric Supply Co., Ltd. (10s.). See our advertisement pages in this issue.

Lancashire Colliery Explosion.—Mr. Robert Nelson, Electrical Inspector of Mines for the Home Office, at the inquest on the Pretoria Pit victims on Tuesday, reported on his visit to the mine, stating that he had seen all the electrical apparatus as soon as he possibly could after the explosion. So far as he had observed, he had seen no breach of electrical special rules in connection with the apparatus; although he would not say the latter represented the very best practice, he would certainly say that, generally speaking, it represented good practice. Regarding the North Plodder section of the yard mine in which the explosion took place, witness stated that the apparatus there was the last he was able to get at. He examined it on December 28th. Almost the last piece of apparatus he looked at was the switch, about which they had heard so much. When he got to the conveyor rails, which he believed to be about four yards from the position of the switch. Mr. Tonge (the general manager) was present, and asked witness to wait a bit, as the place was full of gas, Witness then asked for the switch to be brought down, and he took full responsibility for that action, as he wished to see the electrical apparatus before anyone else. The switch was opened by Mr. Rowland Bull, electrical engineer at the colliery, and witness carefully examined the interior. He had formed the conclusion that there had been no flame inside the switchbox at that time. His reasons were that he found no marks of carbonisation inside the lid of the box, which was painted white, so that he would have anticipated marks. There was no sign of burning or oxidisation on the gauzes, or on a piece of paper which was pasted inside the lid of the box. One of those reasons had, however, since proved to be a faulty one, because when Dr. Thornton and witness repeated the explosion in the box the other day, there was no sign of carbonisation on the lid. He thought, however, that the other two reasons stood, and to his mind proved conclusively that there was no flame inside that particular switchbox. He examined in detail other switches, and was satisfied that no flame came out of them. In reply to the Coroner, Witness said, in his opinion, the switch had caused no ignition. Prof. J. Cadman, of the Birmingham University, formerly an inspector of mines, said he descended the pit on December 30th, and he saw the switch on the 31st in the mine in the North Plodder, about 5 or 6 yds. down the jig from the conveyor face. In his report he said he examined the switch-box, and found no visible trace of flames inside the box. There was no evidence of violence, and there was no marking of the switch contacts such as would be caused by sparking. He arrived at the conclusion that no explosion had occurred in the box. His opinion was that the ignition had not taken place inside the box. Witness added that he had examined the position of the conveyor, and came to the conclusion that the conveyor was not in motion at the time of the explosion, and that the switch had not been put in. The conveyor was not completely filled with coal, and there was coal alongside the conveyor. Prof. Cadman stated that experiments carried out with various quantities of oil in the box showed that even with less oil in it than there was when the switch was first examined, no sparking could take place. On the other hand, when a mixture of coal gas and air was fired in the box, indications of the flames were observed which were not present when the switch was found.

Mr. Rowland Bull, electrician and mechanical engineer in charge of electrical plant at the colliery, said he was with the party which first got to the switch on the Wednesday after the explosion. He was actually first to open it, but Mr. Nelson, the Home Office Inspector, and Mr. Tonge and Mr. J. Bullough were with him. The switch was in gas, and it was brought to them by the rescue men. He found it in a very good condition, and quite satisfactory. There was oil in it, and this about covered the controller drum. Asked whether, in his opinion, it would be possible for the switch to have sparked, the witness said that it would not be possible. Continuing, he said the cutters were disconnected, and there was no possibility of an electrical discharge with them. The cables had been tested, and were found to be correct, so that there would only be the switch left. The rescue men had not been shown the proper way to carry it, because when they got it, it was covered with oil. When they looked into the box the oil covered the point where the contact was made. The switch was inspected daily, and the expert inspector inspected it every month.

Copper.—The general tenour of the review of copper production for 1910 published in the *Financial Times* for January 27th, is that the much-talked-of restriction in output has not come into operation. The total output, according to Messrs. James Lewis and Son's statistics was some 851,000 tons, as compared with 847,000 for 1909, 755,000 tons in 1908, and 720,000 in 1907. The United States showed a lower total at 484,900 tons, whereas the return for 1909 was 487,900. This decrease was due to lower yield from Montana, and the Lake Superior region. Arizona, on the contrary, increased its output 2,200 tons, Utah and Nevada also produced more; and, apart from the States—Australia, Mexico, Peru, and Africa, have increased their output, Spain only being lower than usual.

Consumption has been brisk, increasing in America from 318,900 to 331,700 tons; in England from 68,800 to 96,300; and in France from 58,100 to 65,500; Germany remains steady at 115,400, only 500 tons less than 1909. Interest has at last been directed to stocks in Germany, which are estimated at 17,500 tons, a large increase, whereas stocks in England are down 28,800 tons, and in America (States) 8,800 tons. England imported less copper, the figures being 41,900, as compared with 68,600 tons for 1909. In England and Germany, says the writer, there are no signs of any decline in consumption—on the contrary, the evidence is all the other way. The only country which is likely to show a smaller demand this year is the United States, where dulness in the iron and steel trades is bound to be reflected in the restricted use of copper. The article concludes by pointing out that an agreement to curtail the output in the States would benefit the new rather than the old producers, and therefore appears improbable.

In connection with copper statistics, an interesting point is raised by a writer in the *Financial News* for January 21st. He refers to the discrepancy between the figures for exports from America and those for receipts on this side. The exports for 1910 given by the Copper Producers' Association amounted to 322,513 tons; Government returns put the figures at 297,507 tons; and the receipts on this side were 296,378 tons. What, it is asked, became of the 26,135 tons difference between the first and last figures? A smaller discrepancy was shown in the returns for 1909. It is inferred that these quantities, amounting to some 30,000 tons, should be added to stocks, which at present amount to 160,075 tons. The article has figures estimating the increase in production for 1911 at 50,000 tons, entirely new producers, namely, China, Ray, Miami and Tanganyika, accounting for 27,000 tons, and Utah, Canada, Mexico, Peru and Russia being expected to increase 23,000 tons. In addition to the before-mentioned stocks of copper, says the writer, there is grave suspicion that United States deliveries to consumers have by no means gone into consumption, and that a large secret stock of metal is accumulating in America.

Submarine Cables for Long-Distance Telephone Circuits.—In our report of the discussion on Major O'Meara's paper at the Institution, we find that in condensing Mr. Kingsbury's remarks we failed to convey his meaning accurately, and our report needs correction in the following respects:—He pointed out that if international lines were to be largely used it was inevitable that many of the conversations must be between persons having an imperfect knowledge of each other's language. Consequently, on inter-State lines it was necessary to allow a wider margin of talking efficiency than on single State lines. Using the places which had been mentioned as illustrations only, it might be quite possible for two Englishmen to talk between Calcutta and London, whilst it might not be possible for two persons, having a less perfect knowledge of each other's language, to talk between London and Astrakhan.

Inquiry.—The makers of dry cells bearing a trade mark consisting of a monogram of the letters "S C H" are asked for.

Fatalities.—Sheriff Umpherston conducted an inquiry on Saturday last into the circumstances attending the death of James Robertson, engineer. Deceased was engaged tending a three-throw pump driven by electricity in the pump house at the pit bottom of the shaft of No. 2 Pannie Pit, Kirkcaldy. He was struck by a column of water at a high pressure which escaped from the pump in consequence of the bursting of the outlet valve, and knocked against the iron shield and stand of the controller, his skull being fractured and death being instantaneous. The evidence showed that deceased had gone down to start the pump and was alone in the engine house when the accident occurred. The accident was made known to the engine man in the generating station at the pit head by the ammeter indicating a rise of about 300 amperes, and then suddenly dropping back to between 30 and 40. Investigation was then made, and Robertson was found dead. The jury returned a verdict in accordance with the evidence.

An inquiry was held on January 27th at Ashington, Northumberland, by Deputy Coroner Percy, into the death of George Reaveley, aged 37, engineman at the electric haulage engine in the Bothal yard seam, at Ashington. Mr. T. McKie, electrician to the Ashington Coal Co., stated that the engine that the deceased had been driving was worked by three-phase alternating current. He found the insulation broken down on the reversing side of the switch; the effect of that would be to make the whole of the switch-box "alive." The switch-box, which was of metal, was too large to cover with india-rubber, besides it was liable to get knocked off. The installation was a modern one. The insulation had become broken by a small screw in the top of the switch, which had held the switch blade in the insulating link, having worked loose and come in contact with the metal pin in the insulation box. There was vibration from the switch itself, which, perhaps would work the screw loose. The voltage was sufficient to cause death. Examined by Mr. J. B. Atkinson, mines inspector, witness added that he found the earth wire missing from the engine. It was afterwards found at the end of the engine-room. Witness could not say how the wire came to be off. If the earth wire had been on, the fuses at the cut-off box would have been blown, and the current cut off, and the man would not have received the shock. The deceased was skilled in dealing with motors and was one of the best men they had. Mr. Joseph English, an official of the Northumberland Miners' Association, asked if in the case of the fuses blowing and there being an accumulation of gas, was there a danger of explosion? Witness said that the switchgear was not designed for gassy pits, but if the gas were present it would explode. Mr. English said if an engine of that description were put into a gassy pit, and the fuses blew, there would be an explosion, and the sooner it was known to the public the better A verdict was returned that the deceased had been accidentally electrocuted.

It is reported in the daily Press that John Shepherd, 33, an engineer's fitter, of Peckham, was killed while working at the repairing shop on the L.B. & S.C. Co.'s electric line at Peckham Rye. At the inquest on Tuesday it was stated that Shepherd was found dead on the floor near a carriage he had been overhauling, and it was surmised that while on the roof he had touched the

overhead wires, which carry 6,600 volts, and, leaping into the air, fell on his head, fracturing his skull. The jury, who were informed that the workmen had been repeatedly warned against going on to the top of the trains whilst the current was on, returned a verdict of "Accidental death."

Institution and Lecture Notes.—Liverpool Engineering Society.—On Wednesday last week, a paper was read by Prof. E. W. Marchant, on the subject of "Illumination."

At a meeting of the Engineering Society of the Huddersfield Technical College an interesting lecture was delivered on Wednesday last by Mr. Edgar Lunn, upon "Electrical Power for Industrial Purposes." Mr. Lunn, after observing that it was essential in a busy industrial centre like Huddersfield that the most economical method of driving should be adopted, explained the numerous advantages accruing from the use of electrical power.

Faraday House.—Mr. R. J. Wallis-Jones commences next week a course of demonstration lectures on "Electric Welding" to the senior students at Faraday House.

Aberdeen Electricity Department.—The members of the Corporation electricity department held their annual "At Home" last Friday evening, about 70 members and friends being present. Mr. Bell, the engineer, in an address, said he was pleased to note the increased attention they were paying to matters social. Councillor Gibb, convener of the Electricity Committee, commended the scheme for a benefit society referred to by Mr. Bell, and trusted that by another year it would be in operation. Music and dancing followed.

Electric Signalling.—According to the *Sydney Mail* of December 21st, Mr. A. R. Angus, a Sydney inventor, gave a demonstration on the Mount Kembla Railway coal line recently, before two or three hundred people, including prominent business men and railway officials, of an invention for the prevention of collisions between trains. The invention consists of electrical apparatus on the locomotive and appliances to make contact with ramps placed between the rails at the beginning and end of each section. The contents are connected by wire in such a way that when an engine enters a section the gear is actuated, should there be danger. A whistle is blown automatically, thus warning the driver; but should he fail to take heed of it, the apparatus will do the work itself, and stop the engine.

Graetzin Lamps.—Referring to our note last week, Messrs. Krupka & Jacoby inform us that the whole of the nine lamps tested by the Reichsanstalt are still burning—after more than 6,000 hours.

Annual Dinner.—On Saturday, January 28th, the staff of the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., of Silvertown, held their 28th annual dinner and social evening at the "London Tavern," Fenchurch Street. Mr. Wm. E. Gray was in the chair, and the vice-chair was occupied by the company's Bradford agent, Mr. J. E. Seaman. The principal toast, "Success to the Company, its Agents, and its Annual Dinner," was submitted by the chairman in an appropriate manner, and duly honoured. Mr. A. P. Crouch, the company's secretary, proposed the toast of the chairman in very felicitous terms, and Mr. P. M. S. Brodie was equally happy and reminiscent in toasting the vice-chairman. The committee and the indefatigable hon. secretary, Mr. Geo. Reed, are to be congratulated on their successful efforts. The musical part of the programme was contributed to by Messrs. Reeds, Glemson, Packham, Hills, Spinks, Bryan, Ambler and Jones (accompanist).

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Stoke-on-Trent Federated T.C. on January 26th decided to pay £78 10s. 9d. per annum to Mr. P. J. S. Tiddeman, late electrical engineer to the Stoke-on-Trent Corporation, as compensation for pecuniary loss sustained by the abolition of his office under the Potteries Federation scheme.

The *Australian Mining Standard* states that Mr. H. R. Harper, city electrician, Melbourne, is leaving for a tour of England, America and the Continent, by the *Malwa*, sailing on February 15th, and he expects to be away between seven and eight months. It is expected that Mr. W. H. Alabaster, the chief assistant to the city electrician, will take Mr. Harper's place during his absence.

The Huddersfield T.C. has increased the salary of Mr. Lunn, electrician in charge at the electric light station, from £156 to £170 per annum.

The staff of the Tunbridge Wells Corporation Electricity Works, on January 25th, presented a framed illuminated address to Mr. H. L. P. Boot, consulting engineer, as a token of esteem.

Mr. F. Woods, for several years assistant engineer at the Heston and Isleworth Council's electricity works, has secured an appointment with Messrs. Belliss & Morcom.

The Electricity Committee of the Bradford Corporation has decided to recommend that the salary of Mr. T. Roles, the electrical engineer, be advanced from £600 to £700 on April 1st next, with two further annual increments of £50.

Mr. Arthur Wright has given notice to the Brighton T.C. of his intention to terminate his appointment as consulting electrical engineer at the expiration of six months from January 23rd.

Mr. G. E. Smith, of Salford, has been appointed installation engineer and canvasser to the Barrow-in-Furness Corporation.

Mr. P. O. Wittey, commercial assistant at the Walthamstow electricity showroom, has resigned. The staffs of the meter room and the showroom are to be combined, and the following increases of salary are to be granted:—Mr. G. W. Stubbings, £10 per annum; Mr. F. Gilbertson and Mr. S. Acres, £6 10s. each per annum. The usual commission is to be paid to those members of the meter and showroom department who satisfy the electrical engineer that they are entitled to the same.

General.—Mr. F. N. Pickett, who has for five years been connected with the Adams Manufacturing Co., Ltd.—for the past three years as their London representative—has severed his connection with the company, in order to take up the position of general manager for the Stewart Precision Carburetter Co., Ltd., 199, Piccadilly, W.

The *Australian Mining Standard* states that Mr. H. R. Moors has been appointed consulting engineer in connection with the new electric tramway system at Geelong (V.), and that the Melbourne University Council has appointed Mr. E. B. Brown lecturer on electrical engineering.

Mr. C. A. Park, who has been for 25 years associated with the London and North-Western Railway Co., and since 1886 as superintendent of its carriage department, has been appointed the managing director of the British Westinghouse Electric and Manufacturing Co., Ltd. He succeeds Mr. Newcomb Carlton, who recently retired to take up the position of vice-president of the Western Union Telegraph Co. in New York.

Obituary.—Mr. Eustace Down.—We regret that it is our painful duty to notify the death of Mr. Eustace J. Down, who, during the latter half of 1910, was spending a well-earned holiday amongst us after four years' work in South America. In December he returned to his post of technical engineer at Valparaiso with Messrs. W. R. Grace & Co., agents for the General Electric Co., of America, for Chile, Peru, Bolivia and Ecuador, having visited many of his friends in England and America during his leave of absence, and having spent a considerable time at Rugby and Schenectady in preparation for an indefinite period in South America. The only information available is in brief messages cabled, that, cut off in the flower of his youth, he succumbed to acute appendicitis on January 24th, after an extremely short illness, and at the all too early age of 26. The eldest son of Mr. F. J. Down, so well known in the pioneer days as a member of the firm of Laing, Wharton & Down, he had his first technical training in electrical engineering at the Northampton Institute, and was awarded the diploma at the completion of his course in 1903, having passed through the various classes with distinction. He then went to Schenectady, and was several years passing through the works of the General Electric Co., of America; in response to a call from Messrs. Grace & Co., he was recommended by the G.E. Co. for the South American post. He sailed from New York in November, 1906, to go to Lima to act as first technical assistant, and after eight months was offered, and accepted, the position of chief of their technical department at La Paz and Oruro; in 1909 he was cabled for to take a higher position in their main office at Valparaiso, whither he had only just returned after his holiday, before mentioned. His prospects were exceedingly promising, and he was full of life and hope for a large share in the electrical developments of the great South American Continent. His very rapid progress during the few years he had been in South America only confirmed the high expectations formed by those who had had the privilege of knowing him in his student days. He became a Student I.E.E. in 1903, and an Associate Member only six weeks ago. He was one of the earliest to take the complete electrical engineering course under Dr. R. Mullineux Walmsley, principal of the Northampton Institute, who has followed his career throughout with keen interest, and who is deeply grieved that so promising a future should have been so prematurely ended. To his sorrowing relatives we respectfully offer our sincere sympathy in a loss which we feel must ever be a source of poignant grief to them all.

NEW COMPANIES REGISTERED.

Simplex Acme Patent Fire Alarm Co., Ltd. (113,927)—This company was registered on January 28th, with a capital of £1,000 in £ shares, to acquire from J. R. U. Little a patent relating to thermal frictio contact making devices, and to adopt an agreement with J. R. U. Little. Th subscribers (with one share each) are:—T. Wilks, 41, Kempton Road, Wave tree, Liverpool, secretary; W. W. Turner, 121, Moscow Drive, Liverpool, secretary. Private company. The number of directors is not to be less than two or more than five; the first are to be appointed by the subscribers; qualification, one share; remuneration as fixed by the company. Registered office, 89, Chapel Chambers North, Chapel Street, Liverpool.

Association of Mining Electrical Engineers (Word "Limited" omitted from title by licence of Board of Trade) (113,846).—This company was registered on January 25th, with 1,500 members, each liable for £1 in the event of winding-up, to promote the general advancement of electrical science in its applications to the mining industry. The subscribers are:—W. Maurice, Hucknall Torkard, mining engineer; R. H. Haggie, Tyneholme, Wealdstone, engineer; S. F. Walker, 1, Bloomfield Crescent, Bath, consulting engineer; A. Hall, Daintree House, Nuneaton, mining engineer; P. D. Coates, 55, Ennismore Street, Burnley, electrical engineer; G. H. Winstanley, Culcheth, near Warrington, mining engineer; R. J. Frost, 4, Pawwood, Arksey, Doncaster, mining electrical engineer; J. Glynn Williams, 3, Moresby Parks, Whitehaven, mining electrical engineer; H. J. Fisher, Burn House, Shiney Row, Fence Houses, electrical engineer; J. E. Sayers, 190, West George Street, Glasgow, consulting engineer and electrician. The management is vested in a Council, the first members of which are: W. Maurice (President); W. C. Mountain, electrical engineer, The Hermitage, Gateshead (Vice-President); Prof. W. Robinson, University College, Nottingham (Vice-President); H. Arnott, electrical engineer, Park Road, Bedworth; P. D. Coates; G. Humphrey, electrical engineer, 113, Clive Road, Canton, Cardiff; H. J. Fisher; R. J. Frost; R. Hood Haggie; A. Hall; R. Holliday, electrical engineer, Acton Hall Collieries, Featherstone, near Pontefract; F. O. Kirkup, electrical engineer, Garesfield Colliery, Rowlands Gill, Newcastle-on-Tyne; R. Krall, electrical engineer, Balfour House, Finsbury Pavement, E.C.; S. F. Walker; G. H. Winstanley; J. E. Sayers; F. Cusworth, electrical engineer, 45, Edward Street, East Kirby; T. P. Martin, electrical engineer, 29, Bell Isle Place, Workington; and J. Glynn Williams. Registered office, Bank Chambers, London Road, Derby.

International Electric Co., Ltd. (113,906).—This company was registered on January 27th, with a capital of £30,000 in £1 shares, to carry on the business of manufacturers of and dealers in electric cables, wires, accumulators, lamps, telephones and all kinds of electric, telegraphic and telephonic articles and instruments, &c. The subscribers (with one share each) are:—E. Smith, 85, Gracechurch Street, E.C., solicitor; G. Heyl, 85, Gracechurch Street, E.C., engineer; P. Werner, 85, Gracechurch Street, E.C., clerk. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first; qualification, £100; remuneration, £100 each per annum (chairman, £150). Registered by Cruesemann & Rouse, 85, Gracechurch Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Johnson-Lundell Electric Traction Co., Ltd. (65,699).—Return dated December 28th, filed December 30th, 1910. Capital £300,000 in £5 shares; 56,389 shares taken up; £5 per share called up on 37,121; £190,590 16s. 10d. paid (including £6,561 10s. 8d. on 2,879 shares forfeited), leaving £1,575 13s. 10d. in arrears; £96,340 considered as paid on 19,268 shares. Mortgages and charges: Nil.

Tonyrefail and Gilfach Goch Electric Light Co., Ltd. (78,637).—Issue on December 31st of £45 debentures, part of a series of which particulars have already been filed.

W. A. Stevens, Ltd. (88,754).—Issue on January 9th of £700 debentures, part of a series of which particulars have already been filed.

Weston-super-Mare and District Electric Supply Co., Ltd. (62,306).—Acknowledgment of indebtedness dated December 31st, 1910, supplemental to trust deed of October 29th, 1903, securing a further £2,500 debenture stock (ranking *pari passu* with £35,000 under original deed), charged on the company's electric light and tramway undertaking and its general property, present and future. Trustees: Electric and General Investment Co., 1-2, Great Winchester Street, E.C.

Cleveland and Durham Electric Power, Ltd. (89,539).—Particulars of £75,000 second debentures, created December 16th, 1910, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £10,500. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Urban Electric Supply Co., Ltd. (57,986).—Deed of acknowledgment of indebtedness dated January 4th, 1911, creating a further £200,000 debenture stock, making with £275,000 already created a total of £475,000, supplemental to trust deeds dated July 28th, 1904, and December 17th, 1906, and an acknowledgment of indebtedness dated April 27th, 1907. Property charged: Electric lighting and tramway undertakings, including lands, buildings, material, rolling stock and plant, and company's undertaking and other assets, present and future, including uncalled capital. Trustees: Merchants' Trust, Ltd., 4, Crosby Square, E.C.

CITY NOTES.

Direct United States Cable Co., Ltd.

THE meeting of this company was held at Winchester House, E.C., on Tuesday, January 24th, Mr. E. M. Underdown, K.C., presiding.

In moving the adoption of the report (see ELECTRICAL REVIEW, p. 111), the CHAIRMAN gave a short account of the progress of the company during the half-year. The statement of accounts was very satisfactory, showing a revenue of £61,110, as compared with £60,338 for the corresponding period of 1909, a difference of £772 in favour of the half-year under review. The working and other expenses for the same period, including income-tax, but exclusive of cost of cable maintenance, amounted to £25,832, leaving a balance, as net profit, of £35,277, making, with £4,783 brought forward from the previous half-year, a total of £40,060. Interim dividends of 4s. per share, for the quarter ended September 30th, 1910 (paid October 27th, 1910) and of 4s. together with a bonus of 2s. per share for the quarter ended December 31st, 1910, payable January 31st, 1911, together amounting to £30,355 (both free of income-tax), had been declared, and after setting aside £5,000 to the reserve fund account, the balance of £4,705 on the revenue account had been carried forward. The reserve fund account had been debited with the following amounts:—£6,747 for cable maintenance, £3,278 for expenditure upon property at Ballinskelligs, and £26,028 the cost of diversion of cable to Harbor Grace, Newfoundland, and after being credited with interest on the investments, profit on sale of securities, and amount set aside from revenue, the balance amounted to £513,517. The increased expenditure on the cost of stations was occasioned by the opening of the new station at Harbor Grace. The chief aim of the company in diverting the cable to Harbor Grace was to increase the speed of the cable, and this result had been very largely attained by an increase of 50 per cent. which it was hoped would be still further augmented in the near future. The manager, Mr. Fenn, deserved the best thanks of the shareholders in connection with this matter, his knowledge of the locality and sea-bottom proving very valuable and effecting for the company a very considerable saving on the original estimate of cost. The question had from time to time arisen as to the desirability of ceasing the allocation to the reserve fund from year to year, and it had been suggested that the fund should remain at a sum of £500,000; his colleagues, however, agreed with him that their past practice had better be adhered to, and the allocation would continue, although perhaps not at the same rate. The declaration of a bonus was a new departure in the history of the company, but he trusted it would be the first of many such distributions. With reference to statements that had appeared in the papers as to an agreement between the Anglo-American Telegraph Co. and the Western Union Telegraph Co., two of their partners in the pool, he would only say that having on a previous occasion asked the shareholders to leave their directors a free hand in the matter of any negotiations that might affect the relation of the three companies, he desired to ask them now for a renewal of that confidence. Proposals had come before them, but not such as commended themselves to them as in the interests of the shareholders, and since then no others had been submitted, and once more he asked for a free hand in this matter.

The adoption of the report was seconded by SIR JAMES PENDER, Bart., and carried without discussion.

At the close of the above meeting an extraordinary general meeting was held, when the subjoined special resolutions were proposed:—

1. "That each of the £20 shares of the company be sub-divided into two shares of £10 each, fully paid."

2. "That the articles of association be altered by the substitution, for Article 60, of the following Article:—Every member shall have one vote for every share held by him."

Both these resolutions were carried, subject to confirmation at another extraordinary meeting.

Stock Exchange Notices. — The Committee has appointed Thursday, February 16th, as a special settling day in:—

British Aluminium Co., Ltd.—£800,000 5 per cent. prior lien debentures of £100 each (Nos. 1 to 8,000).

And ordered the undermentioned to be quoted in the Official List:—

British Aluminium Co., Ltd.—600,620 ordinary shares of £1 each, fully paid (Nos. 300,001 to 900,620); 299,570 6 per cent. non-cumulative preference shares of £1 each, fully paid (Nos. 1 to 299,570); £800,000 5 per cent. prior lien debentures of £100 each (Nos. 1 to 8,000); and £720,398 debenture stock.

South London Electric Supply Corporation, Ltd.—The directors recommend, subject to final audit, a dividend on the ordinary shares for the year 1910 at the rate of 5 per cent. per annum. This is the same rate as for 1909.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the five weeks ended December 30th, 1910, were 660,633, compared with 598,714 units in the corresponding five weeks of 1909.

St. James' and Pall Mall Electric Light Co., Ltd.—The directors recommend a balance dividend on the 7 per cent. preference shares for the half-year ending December 31st, 1910, of 3s. 6d. per share, and 5s. per share on the ordinary shares, making, with the interim dividend paid thereon, a total distribution of 10 per cent. This is the same rate as for 1909.

London Electric Railway Co., Ltd.—The directors have declared a dividend at the rate of ¾ per cent. per annum (9d. per share), less income-tax, on the ordinary shares, for the half-year to December 31st.

Metropolitan District Railway Co.—The directors recommend a dividend on the 4 per cent. guaranteed stock for the half-year ended December 31st at the rate of 4 per cent. per annum; and a dividend on the 4½ per cent. first preference stock for the same period at the rate of £3 10s. per cent. per annum, as against no payment for the corresponding period last year. £10,000 has been reserved for renewals and £2,020 is carried forward.

Blackpool and Fleetwood Tramroad Co., Ltd.—The report states that the net profits for the six months to December 31st, including £1,028 brought forward, were £13,642, after providing for debenture interest. A dividend at the rate of 9 per cent. per annum is proposed, adding £3,500 to the depreciation reserve and £750 to the general reserve, and leaving £2,642 to be carried forward.

Great Northern and City Railway Co.

THE directors' report that the total revenue receipts for the six months ended December 31st amounted to £39,066, and the cost of working to £19,958, being at the rate of 51·09 per cent. The net revenue was £19,108, which is insufficient to meet the fixed charges for the half-year; £3,903, provided from outside sources, has enabled the company duly to meet these charges. The number of passengers for the six months, including season ticket-holders, was 5,856,829, as against 5,652,556 for the corresponding period last year. The number of local season tickets issued during the half-year was 2,342, as against 2,917 for the half-year ended December 31st, 1909. The number of three-route season ticket-holders using the company's line during the past half-year was 2,558, as against 2,302.

THE EARL OF LAUDERDALE (chairman) presided on Wednesday at the Westminster Palace Hotel, over the half-yearly meeting.

In moving the adoption of the report, the CHAIRMAN said the last half-year showed results which were more satisfactory than for the corresponding period of 1909. Both traffic and revenue had gone up, whilst working expenses had gone down. The total number of passengers carried was 5,856,829, as against 5,652,556 for the half-year ending December, 1909, being an increase of 204,273. There were 4,900 season-ticket holders, as against 5,219 last year, or 319 less. This difference in number was owing to the introduction of strip tickets in lieu of monthly seasons. These tickets had been found to be most popular with the public. They represented 14·2 per cent. of the total revenue, and no less than 24 per cent. of the revenue for local bookings, and although the number of season tickets had gone down, the revenue from them had increased from £7,272 to £7,752. The local traffic receipts were £1,063 in excess of the 1909 half-year, whilst the saving in cost of working amounted to £648, thus bringing the percentage of working expenses from 54·35 to 51·09, a very satisfactory result. The net difference in their favour through increased revenue and decreased expenditure amounted to £1,804, leaving a deficiency of £3,903, against £5,709 for the half-year of 1909. This deficiency had been met from outside sources, and left the accounts evenly balanced. The specific items comprising the debits and credits were duly set out in the balance-sheet. The train and car-miles were both somewhat in excess of the half-year of 1909, and this was due to an additional train being run during the busy morning service, and to the evening service being extended 14 minutes later. The railway had been efficiently worked during the period under review. From the results it would be readily seen that there was a decided improvement in the half-year, as compared with the corresponding half of 1909, and still more so if they went back to 1908. That was to say, the traffic revenue had been £35,800 for the half-year of 1908, £36,100 for 1909, and £37,200 for 1910; whilst the working expenses had been £21,800 for the half-year of 1908, £20,600 for 1909, and £19,900 for 1910, equal to percentages of 56·18, 54·35, and down to 51·09 for the last half-year, and though these differences were not large, still they indicated a distinct tendency towards gradual improvement in their position, and the regaining of that which they occupied some years ago, when the municipal tramway competition began so seriously to hamper their progress and throw them back. Almost each week of the half-year under review had shown some increase in traffic, and although he admitted that these increases had been very small, they had been continuous and progressive. The directors saw no reason to doubt that the continuous growth of London traffic was making itself felt upon the fortunes of the company. The improvement was chiefly due to the natural growth of traffic, to the introduction of strip tickets, to the extension of workmen's fares from 7.30 to 8 o'clock in the morning, and, in general, to the advantages which the railway afforded of rapid travelling by a constant service of trains which were run at very short intervals during the busy hours of the day. They hoped the steady increase of traffic which had set in would continue to help them. The only new form of competition which had arisen was the extension of the L.C.C. tramways from the foot to the top of Highgate Hill, but it was not expected that this would have any material influence on their traffic. In spite, however, of the extraordinary competition to which they were now, and must, he feared, always be subjected from the County Council tramways, the public was getting to recognise that their service was a cheap and reliable one, and much more expeditious than the tramways. They had been able, fortunately, by certain minor mechanical alterations, to expedite their service, so that they now ran 30 trains an hour during the busy period as against 28 trains last year. They had commenced this half-year well. Their working expenses had been most carefully supervised under every heading, and whilst the proper upkeep of the line and its safe working were always their first consideration, the cost of running had been sensibly lowered. Although it might be a long time before they could present that satisfactory report which, before the opening of the electric tramways in 1907, seemed almost within their reach, they still looked forward to the time when they would not only be able to pay all their fixed charges without having to rely on the kindness of their friends, but even have further increases in their revenue.

MR. C. STEEL seconded the motion, and the report was adopted without discussion.

Urban Electric Supply Co.

ON Wednesday last week an extraordinary general meeting of this company was held at Salisbury House, London Wall, E.C., under the chairmanship of Mr. P. D. Tuckett, for the purpose of considering a draft agreement proposed to be entered into between the company and Edmundson's Electricity Corporation.

The CHAIRMAN stated that it would be remembered that at the last annual meeting he said that he would give the shareholders an opportunity of considering any proposal for entering into negotiations with other companies. The board were not bound to call a meeting, but under the circumstances they thought that perhaps the shareholders ought to hear what was being done. They were probably all aware that the company's agreement with Edmundson's Electricity Corporation for working the Urban Electric Supply Co., and guaranteeing its dividends, expired on December 31st last. The board consequently had to consider what should be done for the working of the company, either by entering into a new arrangement with Edmundson's or providing a separate organisation of their own to manage it. He had no hesitation in saying that the board preferred the former proposal. There was another alternative—amalgamation with Edmundson's, but the directors had unhesitatingly come to the conclusion that it was impracticable at the present moment. Whether that would ever be brought about he did not know, but the present proposal would in no way prejudice such a scheme. The agreement which they now proposed to make with Edmundson's was for a term of seven years, and contained three important provisions. First, that Edmundson's were to continue the management of the company for an inclusive payment of £2,000 per annum. Secondly, the said corporation should carry out all new construction works at cost price plus 10 per cent., and, thirdly, should advance £100,000, as and when required, to the Urban Electricity Supply Co. Edmundson's Corporation were to accept in satisfaction of that sum, either first debenture stock at market price, or second 5 per cent. debentures at 5 points below such first debenture market price. Commenting on the three provisions, the chairman said that they provided for continuity of management. It would take them several years to get such efficient organisation as they now had. The directors, whilst receiving the advice of Edmundson's board, in no way delegated their powers—they, and they only, were responsible. With reference to the 10 per cent. contractors' profit, he could only say they would not get anyone else to undertake the work on similar terms. As regarded the advancing of the £100,000, it might be that Edmundson's might have to realise some of the debentures they held of the Urban Electric Supply Co. In order to meet that a clause had been inserted in the proposed agreement, providing that if Edmundson's sold any of their debentures at less than £82, the Urban Co. were to make it up to that figure, and if they were realised at a higher price the Urban Co. were to get the benefit of it. He concluded by moving a motion to the effect that the agreement be entered into.

MR. GOOTMAN seconded the resolution, and, after a short discussion, it was carried.

The CHAIRMAN said that he would like to say a word of two in reference to the remarks he made at the last annual meeting with regard to the reduction of capital and the payment of dividends. After careful consideration, the board had come to the conclusion that the question of the reduction of capital could be more conveniently dealt with at a later date. They found that the disadvantages at the present moment outweighed the advantages. The dividends would be paid, as hitherto, on May 1st for the year ending December 31st, but he could not hold out any hopes that the ordinary shareholders would have a dividend for several years. As to the preference dividend, they proposed that that should remain in abeyance until the accounts for the present year were available in 1912—in other words, they proposed to hold back the usual October distribution. The new arrangement they proposed to make with Edmundson's would in no way prejudice the position, and he thought the preference dividend would be earned, but it was a question of policy as to how far it should be distributed. With regard to the business generally, they continued to make satisfactory progress, although the increased profits accompanying that progress were not so marked for 1910 as in 1909. The business was extending, and was likely to continue so, and he did not think they need take a pessimistic view of the future such as would make them realise their holding at the present market prices. They would require to exercise a considerable measure of patience before the result realised was commensurate with the money invested in the undertaking. The immediate prospects were disappointing to the ordinary shareholders, but it was only a question of time for the position to right itself.

National Telephone Co., Ltd.—The directors have resolved, subject to final audit, to recommend the following dividends for the half-year ending December 31st, 1910, after payment of the dividends on the preference shares: At the rate of 6 per cent. per annum on the preferred stock; at the rate of 6 per cent. per annum on the deferred stock, less income-tax in all cases, carrying £200,000 to reserve, and about £12,000 forward. The transfer books will be closed from 10th to 23rd inst., both days inclusive, and the dividend warrants will be posted on the latter date.

Clontarf and Hill of Howth Tramroad Co., Ltd.—The directors have declared a dividend at the rate of 3 per cent. per annum.

Lanarkshire Tramways Co.

THE meeting of this company was held on Tuesday at the London offices, 83, Cannon Street, E.C., Mr. A. R. Monks presiding.

The CHAIRMAN, in proposing the adoption of the report (see ELECTRICAL REVIEW, January 27th), said that the traffic revenue showed an increase for the first half of the year of £4,060, and for the second half an increase of £1,340, a total of £5,400. This increase was partly attributable to the Uddingston and Newmains extensions, which were not open for the full year of 1909, and partly to improved trade conditions. The advertising revenue was slightly lower than in 1909, but parcels, discounts and sundry revenue were up, so they had a net gain in gross revenue of £5,440. Taking the expenses, there was an increase in power costs of £600 for the first half of the year, which was explained by the fact that Uddingston and Newmains extension lines were not in operation in the first half of 1909; in the second half of the year there was a small decrease as they reduced the car-mileage. There was an increase of £2,270 in traction expenses—£2,000 in the first half-year and £270 in the second half—which was also due to operating the extension lines for the full year and increased cost of maintaining the track and rolling stock. General expenses were up to the extent of £280, which was entirely due to additional taxation. Their local rates for the current year amounted to about £3,000, so that with their wayleave of £1,650 they are making a total payment to the local authorities for the year of over £4,500, in addition to relieving them of maintaining the roads. The total expenses had increased by £3,110, which, deducted from the increase of £5,440 in the revenue, gave a net improvement of £2,330. As the present reserve for depreciation was invested in the business, the directors had charged the revenue account with interest on the reserve for the past year, and had added same, viz., £1,260 to the fund. After writing £698 off cost of orders, loose tools, &c., transferring £8,500 to reserve for depreciation (a similar amount as in 1909), and making the necessary reserves for local authorities, and for additional remuneration to the directors, the balance allowed for a payment of a dividend for the half-year of 6 per cent. per annum (making 5¾ per cent. for the full year), leaving £1,500 to carry forward. He thought they would agree that these results were very satisfactory. At the conclusion of that meeting they would hold an extraordinary general meeting to approve the application to Parliament to extend for three years the time for constructing their extension lines to Mossend and Bellshill, and for powers to run trackless trolley cars. He understood that their application was being opposed by certain local authorities, and as they had paid for street widenings, local rates, and maintenance of roads, between £60,000 and £70,000, since they commenced operations, he must say that opposition appeared to him incomprehensible.

MR. J. NAUHEIM seconded the motion, and the report was adopted.

The retiring directors and auditors having been re-elected,

MR. NAUHEIM, in moving a vote of thanks to Mr. G. F. Moller and the staff of the company, remarked that the good results of the year's working must be satisfactory both to the directors and shareholders, and there was no doubt that a great deal of that success was due to the careful management on the spot.

MR. G. F. FRANKLIN seconded the resolution, and it was carried.

Subsequently an extraordinary general meeting was held, when the following resolution was carried, on the motion of the CHAIRMAN, seconded by MR. FRANKLIN:—

That this company approves the provisional order deposited at the office of the Secretary for Scotland intituled provisional order to extend the time for the construction of certain authorised tramways of the Lanarkshire Tramways Co., and for the acquisition of lands in connection therewith; to authorise the company to provide and use trolley vehicles; and for other purposes subject to such additions, alterations and variations as may be made during the progress thereof, or as Parliament may think fit to make therein.

City and South London Railway Co.

THE RIGHT HON. C. B. STUART WORTLEY, K.C., M.P., presided on Tuesday at the offices, 71, Finsbury Pavement, E.C., over the meeting of this company.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, January 27th), said the half-year finished better than it began, and they had an increase on receipts from passengers of £1,006, and on season tickets of £628. The gross receipts increased by £1,663, against which expenses were up by £637, so that they carried to net revenue account a sum increased by £1,026. They paid the same dividend as last year, and carried forward £1,076 more. They had carried more passengers and taken more money than in any previous half-year, but their working expenses were fractionally better than they were a year ago; being 45·78 per cent. against 45·92. As compared with December, 1909, they had run more trains, carried more passengers per train, taken more money per train, and more money per train-mile, and spent less per train-mile on locomotive charges. On the other hand, they had taken slightly less money per passenger, and had spent rather more on total expenses per train-mile, and also rather more in traffic expenses per train-mile. The decreased amount taken per passenger was due to the fact that their through bookings with the busiest of the other underground lines all showed increases, which meant that they had been carrying a larger number of passengers at less than their own local fares, owing to the new reduced fares in most cases being less than the combined local fares. By far the most gratifying of these increases occurred in connection with the Metropolitan Railway, and although the traffic at present exchanged was not very large, they hoped that this growing traffic might be still further developed when they got the new low-level subway at Moorgate, sanctioned by Parliament in 1910, which would make closer the connection between the Metropolitan system and their own. Coal cost them more by £600, due to an increase in cost of about 9d. per ton, and an increase in the consumption owing to the larger mileage run. Against unremitting competition they were well holding their own. All who had charge of railway enterprises had to look well ahead and take all new developments into consideration. They saw around them new underground lines, some of which carried passengers at a speed, including stops, of 17 miles per hour, against their own average of 13¼. The public was accordingly learning to expect that improvement to become general. And there could be no doubt that if they could give a service thus accelerated they could contend even more effectively against their great surface competitor, whose speed, notwithstanding his contempt for Board of Trade maximum limits, ought never to be able to exceed that of modern tube trains. This question was mainly one of finance, for a general acceleration of the speed of their trains could not be accomplished without, not only great changes and additions to their rolling stock, but a very considerable increase in siding accommodation. At the same time those and other changes might be so conceived as to make possible a *per contra* saving of part of the expense of the new stock, by enabling them to cease the running of five coach trains in the less busy part of the day, which at present they were obliged to do, partly from want of underground space for siding accommodation, and partly by reason of difficulties which prevented at present the expeditious coupling and uncoupling of their coaches. They had received from municipal and other public bodies on the south side of the river representations in favour of extending their line beyond their present terminus at Clapham Common. This raised the important question whether they would have to follow the population for whom they catered as they continually moved further afield in search of residences further from the crowded centre where their daily business was carried on. And that, like the question of improved speed, raised again the question of finance. On these weighty matters he expressed no opinion that day, but he did hope they might conclude from their receiving the invitations to which he had referred, that should they ever go to Parliament for such purposes they would not go without the powerful support which municipal advocacy alone could supply, and when he said support, he meant whole-hearted support, and not clogged with conditions which made enterprise impossible. Since the last meeting they had received the last of the decisions of rating authorities in pursuance of the Metropolitan Quinquennial Re-valuation of 1910. He knew no reason why such re-valuation should in justice have increased their assessment by a single shilling. On the contrary, he knew of some reasons which would justify exemptions or other preferential concessions to undertakings such as theirs. For not only did they render great services to the convenience and health of the humbler classes of the public, but they were subjected to competition from undertakings either subsidised out of rates, or else free, as the motor-omnibuses were, from having to pay, as they did, rates on the roads that they used. Their assessment had, in fact, been increased by about £300 a year, and it was not without struggles, more or less severe, that they escaped a greater increase. For this result, though they could not be enthusiastic, he supposed they must be thankful. The new rating would come into force on April 1st. As regarded other prospects of the current half-year, he anticipated considerable advantage to their traffic from the attractions of the coming Pageant of Empire at the Crystal Palace, and if they might judge from the experience of 1902, the Coronation celebrations would cause them to be unusually busy. The new half-year had started with a continuation of the substantial weekly increases which marked the close of 1910: and that they had, therefore, the right to ground their hopeful anticipations to that extent on realised results.

MR. C. S. GRENFELL seconded the motion.

The report was adopted, and the retiring directors and auditors re-elected. A vote of thanks to the board and staff was passed on the motion of COL. PERRY, who observed that it was a little disappointing to carry three-quarters of a million more passengers in order to get the same dividend, but they realised that it was only by giving increased facilities that they were able to pay that dividend.

Chatham and District Light Railways Co.

THE meeting of this company was held on Tuesday, at the offices, 83, Cannon Street, E.C., Mr. A. R. Monks, the chairman, presiding.

The CHAIRMAN formally proposed the adoption of the report (see ELECTRICAL REVIEW, January 20th), which was seconded by MR. J. F. NAUHEIM, and carried.

The retiring director and auditor having been re-elected, MR. NAUHEIM proposed a vote of thanks to Mr. W. Jensen, the general manager, and his staff. He said it must be a source of satisfaction to the ordinary shareholders that for the first time since the company had been in existence they were able to pay a dividend at the rate of 4 per cent.; and he hoped that they would be able to maintain it at that rate, if not increase it. It had been a fairly long time before they had attained that dividend, and that they had been able to pay it now was due in a great measure to the careful management of Mr. Jensen and the staff.

MR. H. C. LEVIS seconded the vote, which was carried.

Metropolitan Railway Co.

Sir Charles McLaren, Bart. (chairman), presided on Wednesday last week at the Great Eastern Hotel, E.C., over the half-yearly meeting of the above company.

In moving the adoption of the report (see Electrical Review, page 150), the Chairman said he thought they would all consider the accounts satisfactory, seeing that the expenditure during the half-year showed a decrease under almost every head and the receipts showed a substantial increase. On the expenditure side of the revenue account the only item showing an increase was that on carriage and wagon repairs, where they had spent £2,000 more than in the corresponding period. Their rolling stock was certainly in a better condition to-day than it had ever been. The stock generally presented a better appearance and afforded greater comfort to the passengers. They had more work to do in this direction, and were satisfied that the extra expenditure represented good policy. A sum of £15,365 had been received from other companies for working their trains, and compared with £11,090 last year. On the other side of the same account they would notice that the receipts showed an increase under every head with the exception of a slight decline in the receipts from mineral traffic. Their loss on the Hammersmith and City line was less by about £1,500, and on the East London line by about £300, while their proportion of the profit on the working of the Metropolitan and Great Central joint line north of Harrow was £2,300 better than in the corresponding period. The only other item in the account calling for special mention was the one of £10,000, which they proposed to transfer out of the half-year's revenue to the electrical renewal and depreciation fund, as against £5,000 put to the same fund in the corresponding period. They had had an exceptionally good half-year, and seeing that they could well afford to do it they thought it wise to further strengthen this reserve fund to the extent mentioned. They had not made any call on this fund yet, but they would have to make some heavy calls upon it soon in connection with the alteration and extension of the generating plant at Neasden, and also in connection with the replacement of some parts of the electrical equipments on their trains by appliances of a more up-to-date design, with a view to greater efficiency and economy in working. After taking this extra £5,000 into account and providing for the debenture and preference stocks, they had a balance of £52,500 available for dividend on the ordinary stock. They proposed to use £42,990 in paying a dividend at the rate of 1½ per cent. per annum and to carry forward £9,500. Thus, in addition to paying ½ per cent. more dividend, they were increasing their carry-forward by £3,500 and putting an extra £5,000 aside to help their electrical maintenance in future. The number of passengers carried during the year 1910 was 102,849,458, this being the largest number carried in any one year in the history of the company. Their traffic was increasing all the time, and it was not unnatural that they should get some complaints of overcrowding. They were, however, doing everything they could to meet this, by strengthening the train service where they found it to be necessary. They also proposed to provide centre doors in the cars running on the Circle service, with a view to facilitating the ingress and egress of passengers. The ratio of expenses to traffic receipts during the half-year had been 54·8, as compared with 58·2 in the corresponding period. The ratio of expenses to total receipts during the half-year had been 49·64, as compared with 52·63 in the corresponding half-year. From time to time he had referred to the development of their properties at various points on the line. From 1906 to 1910, their rent roll had increased from £64,621 to £76,129, an increase of nearly £12,000 a year. They were still continuing to develop their resources in this respect, and there was every prospect of their rents being still further increased. On the whole, the result of the half-year's working had been satisfactory, and fully justified the somewhat optimistic predictions that he had made at the last two meetings as to their future. With the resources at their command, there was no doubt whatever that, with judicious management, the business of the company was capable of still further expansion. They would have to spend some more of their capital before very long for the purpose of assisting this development, but this would only be a small matter and one that need not cause them any concern. Proceeding to deal with contemplated works, the Chairman said the most important was the enlargement and reconstruction of Baker Street Station, and within the last few days they had made a contract for carrying out the first part of the scheme. It was proposed to erect new offices for the company in connection with the scheme. At the last meeting he referred to the contract they were about to enter into with the British Westinghouse Co. for the renewal of a large portion of the machinery with a view both to increasing their capacity for the production of energy and to reducing the cost per unit. That contract was entered into, and the work under it was proceeding. Before the end of the current half-year they expected to have the first of the new machines installed and in working order, and if the contract conditions were fulfilled, and they had no reason to doubt that they would be, considerable economy should be effected in their coal consumption. To the extent to which the new machines were replacements of those now existing, the cost would be borne out of the electrical renewals fund. He also mentioned at the last meeting that they were extending the system of all-electric automatic signalling from Baker Street to Neasden. They had completed that work as far as Willesden Green, and it had been brought into operation with very satisfactory results. In this connection it was interesting to know that in reporting to the Board of Trade after inspecting this installation Major Pringle, who was a recognised authority on railway signalling, gave the following very valuable testimony as to the excellence of the system. He said: "I recommend the Board of Trade to approve these new signalling arrangements, which will, in my opinion, not only give greater facilities for service, but provide a larger amount of security than that afforded by lock and block working." Touching next on rates and taxes, the chairman said they had come to settlements with various local authorities, whilst in other cases they had given notice of appeal to Quarter Sessions. The board considered that the whole method of assessing railway companies, and especially the underground and suburban railways in London, was wrong, but until they could get the law altered they were determined not to pay a penny more than they were absolutely obliged to on the existing basis of assessment. Various building schemes were on foot at various places on their line, including garden cities at Ruislip and Wembley, and if these schemes succeeded the company would get a very substantial traffic from them.

Sir Wm. Bibt seconded the motion.

Mr. Walford pointed out that the County Council was proposing to construct tramways along the Marylebone Road, and from Brondesbury to the Marble Arch, and said if this were done it would wipe off the dividend on the ordinary shares of the company. He urged the shareholders to do all they could to oppose the Bill before Parliament.

Mr. Lawson also alluded to the serious nature of the tramway opposition which was threatened. He expressed approval of the contemplated improvements at King's Cross and Baker Street.

Mr. Romain said there was a large district from Brondesbury to Edgware Road which was practically untapped by the company. He suggested for the board's consideration that they might construct a tunnel from their St. John's Wood Road station to Sutherland Avenue. If they had a station there they would tap the whole of the Maida Vale traffic.

Mr. Franklin asked what effect the short-distance tramways had on their short-distance traffic. Did not they in many cases serve as "feeders" instead of "suckers?"

Mr. Inglefield inquired whether the board were considering steel cars or cars trussed on the side. He also advocated the abolition of gas for lighting the cars.

The Chairman said he did not think the company need be under much apprehension with regard to the tramways referred to, as at present the local authorities were opposed to them. The company were, of course, opposed to them, but if they were constructed they did not think the loss would be anything like that predicted by Mr. Walford. He did not think that spur lines would pay, but they would consider Mr. Romain's proposal. The greater part of their new cars were made of steel, and he thought they were quite strong enough.

The motion was then agreed to.

A special meeting was subsequently held, when the shareholders gave their approval to the company's Bill deposited in Parliament, which provides, amongst other things, for the construction of a station at Mount Pleasant.

Anglo-American Telegraph Co., Ltd.

The directors' report states that the total receipts from July 1st to December 31st, 1910, including £18,297 brought forward, amounted to £249,565. The traffic receipts show an increase of £6,832 as compared with the half-year ended December 31st, 1909. The working expenses of the half-year amounted to £79,456, being a decrease of £893, as compared with the corresponding period of 1909. The directors had, before declaring the net profits, set apart £10,000 to the renewal fund, leaving a balance of £160,109. Quarterly interim dividends of 15s. per cent. on the ordinary stock, and £1 10s. per cent. on the preferred stock, were paid on November 1st last, absorbing £52,500, leaving a balance of £107,609, out of which the directors recommend the proprietors to declare final dividends of £1 10s. per cent. on the ordinary stock, £1 10s. per cent. on the preferred stock, and £1 10s. per cent. on the deferred stock, payable on February 4th, amounting together to £105,000, making a total distribution for the year ended December 31st, 1910, of £3 15s. per cent. on the ordinary stock, £6 per cent. on the preferred stock, and £1 10s. per cent. on the deferred stock. The balance of £2,609 will be carried forward to the next account. A provisional agreement has been entered into between this company and the Western Union Telegraph Co., which is subject to confirmation by the stockholders of this company at special meetings of the stockholders hereafter to be convened, and to confirmation by the stockholders of the Western Union Telegraph Co., and is also subject to the settlement of legal formalities. The principal condition of the agreement is that the Western Union Co. gives the Anglo Co. a guarantee of 3¾ per cent. on the total capital, £7,000,000, in perpetuity. The companies will continue distinct.

The meeting is to be held to-day, February 3rd, at 2 o'clock.

Dublin United Tramways Co. (1896), Ltd.—The directors' report states that the amount available for division is £55,798, out of which it is recommended that dividends be paid for the half-year to December 31st at the rate of 6 per cent. per annum, less income-tax, on both the preferred and ordinary shares, and that £12,000 be set aside towards the renewal of permanent way. The dividends and the sum set aside will absorb £45,900, leaving £9,898 to be carried forward.

Aron Electricity Meter, Ltd.—Letters of allotment in the issue of £100,000 5 per cent. first mortgage convertible debentures by this company have been posted.

MARKET QUOTATIONS.

Wednesday, February 1st.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a " Nitric	"	22/-	..
a " Oxalic	"	28/-	..
a " Sulphuric	"	5/6	..
a Ammoniac, Sal	"	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£29	..
a " "	"	£30	..
a Bleaching powder	"	£5 10	..
a Bisulphide of Carbon	"	£18	..
a Borax	"	£16	..
a Ferro-Silicon (50 %)	"	£9 10	..
a Copper Sulphate	"	£21	..
a Lead, Nitrate	"	£25	..
a " White Sugar	"	£22 15	..
a " Peroxide	"	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (75/80 %) ..	per ton	£30	..
a " Chlorate	per lb.	8½d.	..
a " Perchlorate	"	4½d.	..
a Potassium, Cyanide	"	7d.	..
a Shellac	per cwt.	80/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	"	£6 10	..
a " Recovered	"	£5 10	..
a " Lump	"	£5	..
a Soda, Caustic (white 70 %) ..	"	£11	..
a " Chlorate	per lb.	3½d.	..
a " Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
a " Cyanide (basis 100 %) ..	"	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£75	£5 dec.
b " Wire, in ton lots ..	"	£102	£10 dec.
b " Sheet, in ton lots ..	"	£120	..
p Babbitt's metal ingots	"	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	6½d.	..
c " Tube (brazed)	"	8¾d.	¼d. dec.
c " " (solid drawn) ..	"	6¾d.	¼d. dec.
c " Wire, basis	"	6¾d.	..
c Copper Tubes (brazed)	"	8¾d.	¼d. dec.
c " " (solid drawn	"	8¾d.	¼d. dec.
g " Bars (best selected) ..	per ton	£89	£2 dec.
g " Sheet	"	£99	£2 dec.
g " Rod	"	£69	£2 dec.
e " (Electrolytic) Bars ..	"	£57 10	£1 dec.
e " " Sheets ..	"	£78 10	£1 dec.
e " " Rod	"	£61	£1 5 dec.
e " " H.C. Wire	per lb.	7⅞d.	1/32d. dec.
f Ebonite Rod	"	6/-	..
f " Sheet	"	5/6	..
n German Silver Wire	"	1/11	..
h Gutta-percha, fine	"	8/6	..
h India-rubber, Para fine	"	5/7	9d. inc.
l Iron Pig (Cleveland warrants) ..	per ton	49/1½	8¾d. dec.
l " Wire, galv. No. 8, P.O. qual.	"	£14	..
g Lead, English Ingot	"	£18	5/- dec.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£8	..
d Mica (in original cases) small ..	per lb.	6d. to 1s.	..
d " " " medium	"	2/6 to 4/-	..
d " " " large ..	"	4/6 to 8/6	..
p Phosphor Bronze, plain castings	"	11d.	..
p " " rolled bars & rods	"	1/0½	..
p " " rolled strip & sheet	"	1/1	..
o Platinum	per oz.	160/-	..
e Silicium Bronze Wire	per lb.	8¾d.	¼d. dec.
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	"	£194 to £195	£4 inc.
n " Wire, Nos. 1 to 16	per lb.	2/-	..
p White Anti-friction Metals ..	per ton	£45 to £150	..
k Zinc, Sh's (Vieille Montagne bnd.)	"	£29 15	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

STOCKS AND SHARES.

Tuesday Evening.

THE reduction in the Bank Rate to 4 per cent. last Thursday failed to enliven Stock Exchange markets to the extent which many people hoped it would do. As usual, the event turned out to have been fully discounted. That it will be beneficial later on, there can be no doubt, because it is the herald of the cheaper money which generally comes in the summer time. Nevertheless, the mere fact that it failed to stimulate business has led, as already mentioned, to disappointment, and, after the cheerfulness of last week, the markets have fallen back into a more or less jog-trot condition. Still the electricity departments are mostly good, and prices on balance show a majority of rises.

Home Railway dividends, so far, have come up to expectations, but as they have not exceeded them, except in one or two instances, prices are a little inclined to slip back amongst the steam stocks. The electrical issues, however, keep firm, and Central London Ordinary and Deferred, in rising a point apiece, show that there are some people alive to the excellent possibilities in front of the company, now that its capacity of forming a direct link between East and West is on the high road to being more practically recognised. Metropolitans, *ex* 15s. per cent. dividend, have fallen ¾, while Districts drooped ¼. There has been a point rise in the first Preference stock upon the declaration of a dividend at the rate of 3½ per cent., making 3¼ per cent. for the full year on the 4½ per cent. first Preference stock. Some of the prophets had been looking for 4½ per cent., but the company wisely decided to strengthen some of its funds, though at the immediate expense of the proprietors, and accordingly the talk about an early dividend on District Ordinary stock has become distinctly subdued.

East London rose to 4, and the "C" Debenture stock to 7. City and South London Ordinary remains depressed, and the price has slipped back to 28.

The demand for Electricity Supply shares continues quietly. So far as the price movements are concerned, there is not much to report, but an amount of buying is going on which cannot fail to have an effect upon prices if it be maintained in the same proportion. The actual changes in the quotations include rises in Charing Cross Ordinary, Chelseas, Bromptons, City "Lights," and St. James' Ordinary, the only declines in the list being in Urban Ordinary shares and Debenture stock. Metropolitans have held their substantial rise, and business is gradually broadening.

Again, one of the principal features of the week is a further material rise in the price of Rio Tramways, which rose three points to 110 on strong buying from Montreal, supplemented by investment demand on this side. For this, of course, the company's recent report with its splendid figures is mainly responsible, and the buying has spread to some of the other descriptions in this division. Mexican Light and Power Ordinary and Preferred are both strong, while the amount of business which takes place in the bonds of the different companies in this group, shows how they are becoming appreciated as good 5 to 5½ per cent. investments. Mexico Tramways shares have advanced, and so have Sao Paulo. Shawinigan Water and Power capital stock has attracted a considerable amount of attention, and brisk business has been done up to as high as 120. The company's 5 per cent. bonds rose to 107, and the 4½ per cent. perpetual Debenture stock is 103 middle. A newcomer to the List is the Electric Light and Power Company of Cochabamba, the 6 per cent. bonds of which are quoted 95 to 97. It seems high time, by the way, that the Pachuca Company's bonds should be admitted to a Stock Exchange official quotation. The price has risen to 90½.

Other traction descriptions are steady to good. Anglo-Argentine Tramways second Preference are being bought on account of their comparatively good yield, and the price has responded. Capes are 1/16 better on what is regarded as the brighter outlook, and the London issues keep firm, without nominal alteration.

Nor is the manufacturing section overlooked. Even Edison and Swan "A" shares have achieved a rise of 7½d., which raises the lower quotation to that figure, from the round 0. Telegraph Construction shares and Debentures are both 10s. up, British Insulated Ordinary rose 2s. 6d., and the Preference shares, marked *ex* 3s. dividend, have not changed in consequence of it. Babcock and Wilcox recovered their slight decline of last week. The company's last balance-sheet, by the way, was chosen by Mr. Hartley Withers in his recent book, "Stocks and Shares," to illustrate what a strong and clean statement ought to be, and the commendation of so great an authority goes for much. Castner-Kellners are also harder.

An excellent report from the National Telephone Company has brought about a keen demand for the Deferred stock, the price of which has jumped 6 points. Accompanying this has come quieter buying of the third Preference shares, which sent up the price to 5½. There are rumbles of indignation beginning to be heard from holders of the second Preference at the exceedingly substantial amounts which the company is putting to its reserve funds, since the second Preference have the right to share with the Ordinary stock in any surplus dividend declared over and above 6 per cent. on the latter, which has improved only to the extent of ¼. Other Telephone issues are firm, and Oriental Ordinary show a small advance.

Most of the changes in the Telegraph market are in the right direction for holders. The investor buys the Debenture stocks whenever any come on offer, and the various gains of half-a-point reflect this appetite for the best-class goods. Great Northerns and Indo-Europeans are 10s. and 20s. higher respectively. Cuba Telegraphs rose ¼, and the Preference twice as much. West India and Panama continue to be bought largely by speculators and investors alike; at 2⅛ the price shows a rise of 3/32 on the week. Anglo-American Telegraphs have quieted down after the dividend excitement. A trifling decline in the Deferred is balanced by steadiness in the Preferred, which still looks a good investment stock at 115, with sound prospects of going in time to 120 or more. Henley's are stronger and Callender's quiet.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1907.	1908.	1909.	1910.	Closing Quotations Jan. 24th.	Closing Quotations Jan. 31st.	Business done week ended Jan. 31st, 1911. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
300,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	5⅝ — 6⅛	5⅝ — 6⅛	5 31/32	..	..	Nil.
$263,244,000	Do. 5 % Deb. Red. Iss. at 98 % script all paid	Stock	5 %	5 %	5 %	5 %	96 — 98	96 — 98	97½	96½	..	5 2 0
$255,196,000	American Telephone & Telegraph, Cap Stock ..	$100	8 %	8 %	8 %	..	147 —149	147 —149	..	..	..	5 7 5
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	93½ — 95½	94 — 96	..	..	+ ½	4 3 4
545,920	Anglo-American Telegraph	Stock	3¾%	£3 4s.	3⅜%	3¾%	71 — 73	70½ — 72½	70⅝	..	— ⅛	5 3 5
3,227,040	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	114¼—115¼	114 —115	115	114½	— ¼	5 4 4
3,227,040	Do. do. do. Deferred	Stock	1 %	8/-	25/-	30/-	28⅛ — 28½	28¼ — 28⅜	28⅜	28 7/16	— ⅛	5 5 3
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	102 —104	102 —104	..	..	..	4 16 2
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	6 15/16 — 7 1/16	6 15/16 — 7 1/16	..	..	..	5 11 4
2,462,309	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	85 — 87	86 — 88	87½	86	+1	4 10 11
16,000	Cuba Telegraph	10	6 %	6 %	6 %	..	8⅞ — 9⅛	9 — 9¼	..	..	+ ⅛	6 3 1
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	..	16¾ — 17½	17 — 18	..	..	+ ½	5 11 1
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	..	3⅞ — 4	3¾ — 4	..	..	..	5 0 6
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10%	8¼ — 8⅝	8¼ — 8⅝	..	..	..	5 14 3
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	99½—101½	99½—101½	..	..	..	4 8 8
60,710	Direct United States Cable	20	4½%	4½%	4 %	5 %	15⅝ — 16	15⅝ — 16	15⅝	..	..	4 17 10
32,500	Direct W. India Cable, 4½% Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	..	134 —137	135 —138	136½	134	+1	5 1 5
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	84 — 86	84 — 86	85⅝	84½	..	4 1 5
1,896,706	Do. 4 % Mort. Deb. Stock Red. ..	Stock	4 %	4 %	4 %	4 %	100 —102	100½—102½	101⅛	100⅝	+ ⅛	3 18 1
300,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	..	12⅞ — 13¼	12⅞ — 13⅛	13 3/16	13⅛	..	5 6 8
752,400	Do. 4 % Deb. Stock..	Stock	4 %	4 %	4 %	4 %	100 —102	99 —101	..	..	—1	3 19 3
200,000	East. & S. Afric. Tel., 4 % Mt. Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5⅞%	5⅝%	5⅞%	..	10½ — 10⅝	10½ — 10⅝	10 31/32	10 7/8	..	5 9 5
181,127	Do. do. 6 % Pref.	10	6 %	6 %	6 %	..	13¼ — 13⅜	13¼ — 13⅜	13 1/16	13 1/16	— ⅛	4 8 1
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	20 %	18 %	18 %	..	31½ — 32¼	32 — 33	..	..	+ ½	5 9 1
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	..	54 — 56	55 — 57	55½	..	+1	5 14 0
$41,380,400	Mackay Companies Common	$100	4 %	4 %	4½%	..	94 — 97	94 — 97	93⅝	..	..	4 7 8
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	77 — 79	77 — 79	78½	..	..	5 1 3
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	3/16 — ¼	⅜ — 7/16	16/6	15/6	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	6 %	6 %	6 %	..	¾ — 1	¾ — 1	..	..	..	6 0 0
86,492	Do. do. do. 5 % Pref.	1	5 %	5 %	5 %	5 %	29/32 — 31/32	29/32 — 31/32	..	..	..	5 11 1
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	106½—107¼	106¾—107¼	107¼	106⅝	+ ¼	5 11 4
3,725,000	Do. do. Def. Stock	100	6 %	6 %	6 %	6 %	126 —128	134 —136	136	134½	+8	4 8 3
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	10 — 10⅜	10 — 10⅜	..	..	..	5 11 8
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10 — 10⅜	10 — 10⅜	..	..	..	5 11 8
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5 25/32 — 5 29/32	5 27/32	5 25/32	+ ⅛	4 5 1
2,200,000	Do. do. 3¾ % Deb. Stock Red. ..	Stock	3¾%	3¾%	3¾%	3¾%	98 —100	98 —100	98¼	98	..	3 10 0
1,988,593	Do. do. 4 % Deb. Stock Red.. ..	100	4 %	4 %	4 %	4 %	98 —100	98 —100	..	..	..	4 0 0
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid..	1	8 %	8 %	8 %	..	1 5/16 — 1 11/16	1⅜ — 1⅞	33/6	..	+ 1/16	4 11 5
50,000	Do. do. do. 6 % Cum. Pref. ..	1	6 %	6 %	6 %	..	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..	..	4 7 3
195,955	Do. do. do. 4 % Red. Deb. Stock. ..	100	4 %	4 %	4 %	4 %	87 — 89	87 — 89	..	..	..	4 9 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	4 %	4 %	4 %	97 — 99	97½ — 99½	..	..	+ ½	4 0 5
11,889	Reuter's	8	5 %	5 %	5 %	..	7½ — 8	7½ — 8	7 9/16	..	..	5 0 0
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	96¼ — 98½	96½ — 98½	97⅛	97⅛	..	4 11 5
2,992	Submarine Cables Trust.	Cert.	6 %	6 %	6 %	..	132 —135	132 —135	..	..	..	4 8 11
150,000	United River Plate Telephone	5	8 %	8 %	8 %	..	7¼ — 7½	7¼ — 7½	7½	..	..	5 6 8
40,000	Do. 5% Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5¼ — 5½	5¼ — 5½	..	..	..	4 6 11
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	2½%	2½%	2½%	..	1¼ — 1½	1¼ — 1½	..	..	..	4 3 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	97 — 99	97½ — 99½	..	..	+ ½	4 0 5
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930 ..	10	7 %	7 %	7 %	..	13½ — 14	13¾ — 14	13⅞	13⅝	..	4 17 5
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	99 —101	99½—101½	..	..	+ ½	3 18 10
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	..	2 1/16 — 2 3/16	2 1/16 — 2 1/8	54/4½	50/-	+ 5/32	Nil
84,563	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	10 — 10¼	10 — 10¼	10 1/16	..	..	5 14 3
4,669	Do. do. 6 % Cum. 2nd Pref.	10	£2 6	15 %	14½%	..	8⅞ — 9¼	8¾ — 9¼	..	..	..	6 9 9
80,000	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	100⅜—102⅜	101 —103	..	..	+ ⅜	4 17 1

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5% Cum. 1st Pref. 1 to 640,000	5	..	..	5 %	..	4 13/16 — 5 1/16	4 13/16—5 1/16	100/-	97/6	..	4 19 3
500,000	Do. 5 % 2nd Pref., 800,000 to 1,800,000	5	..	..	5 %	..	4⅜ — 4 9/16	4⅜ — 4⅝	91/3	89/9	+ 1/16	5 8 1
4,465,674	Do. 4 % Deb. Stock	Stock	..	4 %	4 %	4 %	91 — 93	91½ — 93	92⅛	91½	+ ½	4 6 0
329,002	Auckland E. Trams, 5 % 1st Mort Deb. Stock ..	100	5 %	5 %	5 %	5 %	101½—103½	101½—103½	..	..	..	4 16 7
880,000	Babcock & Wilcox, 1 to 880,000	1	20 %	20 %	24 %	..	5⅛ — 5⅜	5⅛ — 5⅜	5 3/32	5⅛	+ ⅛	4 2 1
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	..	1⅜ — 1½	1⅜ — 1½	..	..	..	4 0 0
600,000	British Columbia E. Rail Def. Ord. Stock ..	100	8 %	8 %	8 %	..	145 —148	145 —148	147½	147	..	4 10 11
600,000	Do. Pref. Ord. Stock	100	5 %	6 %	6 %	..	128 —132	126 —130	128	126⅔	..	4 8 6
600,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	..	110 —113	110 —113	111⅔	110⅔	..	4 9 3
230,800	Do. 4½ % 1st Mort. Deb., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	102½	..	..	4 6 7
210,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	101 —104	102 —105	..	..	+ 1	4 5 9
133,301	British Electric Traction	10	Nil	Nil	Nil	..	1⅜ — 1⅝	1⅜ — 1⅝	28/9	27/6	..	Nil
161,487	Do. do. 6 % Cum. Pref.	10	3 %	1¾%	Nil	..	3¾ — 4¼	3⅞ — 4¼	80/7½	80/-	..	Nil
1,473,653	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	..	91 — 95	91 — 95	93¼	92½	..	5 5 3
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	73 — 78	73 — 78	..	..	..	5 15 5
100,000	British Insulated and Helsby Cables	5	10 %	10 %	10 %	..	6⅞ — 7⅛	6⅞ — 7⅛	7⅛	7 1/16	+ ⅛	6 15 7
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	..	5⅞ — 6⅛	5⅞ — 6⅛	..	..	..	4 16 0
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
201,579	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
500,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 75,000	5	Nil	Nil	Nil	..	¼ — ⅜	¼ — ⅜	..	..	..	Nil
1,241,358	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	57 — 60	56 — 59	56	..	+ 2	6 15 7
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	9/16 — 11/16	9/16 — 11/16	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,888	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	Nil	Nil	Nil	..	0 — ⅛	0 — ⅛	..	..	..	Nil
199,885	Do. do. Non-cum. 7 % Pref... ..	2	Nil	Nil	Nil	..	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	37 — 42	37 — 42	..	..	..	10 14 4
125,000	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	21 — 25	21 — 25	..	..	..	18 0 0
137,610	Calcutta Trams, 1 to 137,610	5	6 %	4½%	4½%	..	5 — 5⅛	5 — 5⅛	5⅛	5⅛	..	4 1 10
47,295	Do. 5 % Cum. Pref., Nos. 1 to 29,330..	5	5 %	5 %	5 %	..	4⅞ — 5⅛	4⅞ — 5⅛	..	..	..	5 0 0
350,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	..	..	..	4 10 11
85,000	Callender's Cable Construction shares	5	15 %	15 %	10 %	..	9⅛ — 9⅜	9⅛ — 9⅜	..	..	..	5 0 0
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	4¼ — 5	4¼ — 5	..	..	..	4 18 9
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	102 —104	102 —104	103⅜	..	..	4 6 7
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	..	1⅜ — 1⅝	1⅞ — 2⅛	10/7½	10/3	+ 1/16	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	12 %	12½%	17½%	..	3 3/16 — 3 7/16	3⅜ — 3½	68/9	61/10½	+ 5/16	5 7 8
205,369	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4 %	4½%	4½%	105 —108	108 —106 xd	..	..	..	4 4 11
1,854,720	Central London Railway, Ord. Stock	Stock	3 %	3½%	3 %	3 %	64 — 66	65 — 67	66½	65⅔	+1	4 9 7
572,640	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	85 — 87	85 — 87	86¾	86¼	..	4 12 0
572,640	Do. do. Def. do.	Stock	2 %	2½%	2 %	2 %	46 — 48	47 — 49	48¾	47	+ 1	4 1 8
1,480,000	City and South London Railway	Stock	2½%	1½%	1½%	1½%	28 — 29	27½ — 28½	28¾	27½	— ½	3 10 2
85,000	Crompton & Co., Nos. 1 to 85,000	8	5 %	Nil	Nil	..	⅛ — ¼	⅛ — ¼	..	..	..	Nil
100,000	Do. 5 % 1st Mort. Reg. Debs., 900 of £100, and 901 11,000 of £50 Red	..	5 %	5 %	5 %	5 %	70 — 80	70 — 80	..	..	..	6 0 5

* Unless otherwise stated, all shares are fully paid. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued.*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Jan. 24th.	Closing Quotations Jan. 31st.	Business done week ended Jan. 31st, 1911.		Rise + or Fall —	Present Yield per cent.
		*	1907.	1908.	1909.	1910.			Highest	Lowest		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	6 %	5 %	6 %	12/- — 13/-	12/- — 13/-	..	..	+ 1/-	5 2 7
805,000	Do. do. 6 % Cum. Pref., 1 to 805,000	1	6 %	6 %	6 %	..	12/- — 13/-	12/- — 13/-	..	..	..	6 0 0
265,480	Do. do. 4½ % Deb. Stock	100	4½ %	4½ %	4½ %	4½ %	97 —100	97 —100	..	..	..	4 10 0
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12½ — 13½	12½ — 13½	..	..	..	4 8 11
99,261	Edison & Swan Utd., "A" shs., £8 pd., 1 to 99,261	5	2½ %	Nil	Nil	..	0 — ⅛	0 — ⅛	..	..	+ 1/32	Nil
17,189	Do. "A" shares, 01—017,189	5	2½ %	Nil	Nil	..	1 — 1⅛	1 — 1⅛	..	..	..	Nil
807,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	61 — 66	61 — 66	..	..	..	6 1 3
67,730	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	77 — 80	77 — 80	..	..	..	6 5 0
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	..	1/16 — 1/32	1/16 — 1/32	..	..	..	Nil
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	7 %	..	1 3/32 — 2 1/32	1 3/32 — 2 1/32	..	..	..	6 16 7
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	8 — 8⅛	8 — 8⅛	..	..	..	5 17 8
200,000	Do. do. 4 % Mort. Deb.	Stock	4 %	4 %	4 %	4 %	80 — 84	80 — 84	..	..	..	4 15 3
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	½ %	Nil	Nil	..	¾ — 1	¾ — 1	..	..	..	Nil
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10½ — 10⅔	10½ — 10⅔	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103½	102 —103½	..	..	..	4 16 10
40,000	Henley's (W.T.), Telegraph Works, Ord.	5	15 %	15 %	15 %	..	12⅝ — 12¾	12½ — 13	12 11/16	12⅝	+ ⅛	5 15 5
40,000	Do. do. 4½ % Pref.	5	4½ %	4½ %	4½ %	..	5 — 5¼	5 — 5¼	..	..	..	5 4 8
150,000	Do. do. 4½ % Mort. Deb Stock	Stock	4½ %	4½ %	4½ %	4½ %	107 —109	107 —109	..	..	..	4 5 9
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10 %	10 %	10 %	..	15⅜ — 16½	15⅜ — 16⅝	16½	15⅝	..	6 4 0
37,500	†Liverpool Overhead Railway, Ord.	10	½ %	Nil	Nil	1½ %	1 7/16 — 1 9/16	1⅜ — 1⅝	..	..	+ 1/16	9 4 7
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	6⅞ — 7¼	6⅞ — 7¼	..	..	..	6 15 7
600,070	London United Trams. (1901) 1 to 50,007	10	3 %	Nil	Nil	..	1⅛ — 2⅛	1⅛ — 2⅛	..	..	..	Nil
399,930	Do. do. 50,008 to 100,000	10	3 %	Nil	Nil	..	1⅛ — 2⅛	1⅛ — 2⅛	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5⅓ %	Nil	..	1⅝ — 2⅛	1⅝ — 2⅛	..	..	..	..
1,649,930	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	65 — 69	65 — 69	..	..	..	5 16 11
5,782,062	Metropolitan Consolidated	100	1½ %	1½ %	1 %	1½ %	42 — 42½	40⅜ — 41½ xd	42½	40⅜	..	2 14 11
2,640,914	Do. Surplus Lands	100	2¾ %	2¾ %	2¾ %	2¾ %	64 — 66	63 — 65 xd	..	..	..	4 8 4
3,235,000	Do. District	100	Nil	Nil	Nil	Nil	27 — 27⅛	26⅞ — 27⅛	27⅜	26 15/16	— 1/16	Nil
391,337	Metropolitan Electric Trams., Ord.	1	..	4½ %	5%	..	2 3/32 — 2 5/32	2 3/32 — 1 31/32	20/6	19/9	..	4 17 7
314,016	Do. do. Defd.	1	Nil	Nil	Nil	..	3/32 — 5/32	3/32 — 5/32	4/-	3/9	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	..	⅞ — 1	⅞ — 1	19/-	18/6	..	5 0 0
589,183	Do. do. 4½ % Deb. Stock Red.	100	4½ %	4½ %	4½ %	..	99 —101	99½ —101½	101½	100½	+ ½	4 8 8
$10,828,200	Mexico Trams Co., Common Stock	..	..	..	6 %	..	124 —126	125 —127	127	125½	+ 1	4 14 6
$9,000,000	Do. 1st Mort. 50-year 5 % Gld. Bds.	..	..	5 %	5 %	..	98½ — 99½	99½ —100½	99½	99½	+ ½	4 19 9
245,000	Potteries Electric Traction	1	4 %	Nil	2 %	..	1/16 — 3/32	1/16 — 3/32	..	..	..	6 8 0
245,000	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	..	⅛ — ⅜	⅛ — ⅜	..	..	..	7 5 5
245,000	Do. 4½ % Deb. Stock	100	4½ %	4½ %	4½ %	4½ %	80 — 83	80 — 88	..	..	..	5 8 5
37,350	Telegraph Construction and Maintenance.	12	17½ %	15 %	17½ %	..	38½ — 40½	39 — 41	..	..	+ ½	5 6 8
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	99½ —101½	100 —102	..	..	+ ½	3 18 5
1,000,000	Underground Electric Railway, 5 % Prior Lien	..	..	5 %	5 %	..	102½ —103½	102⅜ —103½	103½	103⅜	..	4 16 7
2,818,700	Do. do. 4½ % Bonds.	..	..	4½ %	4½ %	..	95 — 97	96 — 98	96⅜	96	+1	4 11 10
4,928,050	Do. do. 6 % Income Bonds	..	..	..	..	1 %	42 — 44	44 — 46	43/4	43/8	+2	2 3 6
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	1	10 %	5 %	Nil	..	1/16 — 3/32	1/16 — 3/32	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	5	6 %	6 %	8 %	..	1 — 1⅛	1 — 1⅛	..	..	..	10 0 0
215,769	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	55 — 65	55 — 65	..	..	..	6 8 1

ELECTRICITY SUPPLY COMPANIES.

30,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10 %	10 %	..	6⅞ — 7⅛	7 — 7⅛	..	..	+ ⅛	6 13 4
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	..	6⅞ — 7⅛	6⅞ — 7⅛	..	..	..	4 14 11
402,000	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	99 —103	99 —103	..	..	..	3 17 8
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	..	3⅝ — 4⅛	3⅝ — 4⅛	..	..	+ ⅛	5 17 8
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½ %	4½ %	4½ %	..	4⅛ — 4⅜	4⅛ — 4⅜	..	..	..	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½ %	4½ %	4½ %	..	3⅝ — 4⅛	3⅝ — 4⅛	76/10½	..	..	5 7 6
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	95 — 97	95 — 97	..	..	..	4 2 6
49,486	Chelsea Electricity Supply, Ord.	5	4½ %	4½ %	4½ %	..	3½ — 4	3⅝ — 4⅛	77/6	75/-	+ ⅛	4 17 0
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½ %	4½ %	4½ %	4½ %	98 —100	98 —100	..	..	..	4 10 0
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	7 %	..	11½ — 12	11⅝ — 12⅛	12⅛	11⅞	+ ⅛	5 15 6
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	..	12 — 13	12 — 13	..	..	..	4 12 4
400,000	Do. 5 % Db. Stk.	Stock	5 %	5 %	5 %	5 %	118 —122	118 —122	..	..	..	4 2 0
800,000	Do. 4½ % 2nd. Db. Stk.	100	4½ %	4½ %	4½ %	4½ %	99 —102	99 —102	99⅞	..	..	4 8 8
50,000	County of Durham Electrical Power, Ord.	5	2 %	Nil	Nil	..	1½ — 2	1½ — 2	..	..	..	Nil
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	..	2⅝ — 3⅛	2⅝ — 3⅛	..	..	..	7 16 10
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	5 %	5 %	5 %	92 — 94	92 — 94	..	..	..	5 6 5
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	..	7⅜ — 7⅝	7⅜ — 7⅝	..	..	..	6 7 0
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	..	10⅝ — 11	10⅝ — 11	..	..	..	5 9 1
450,000	Do. do. 4½ % Deb. Stock	Stock	4½ %	4½ %	4½ %	4½ %	104 —107	104 —107	..	..	..	4 4 1
450,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½ %	4½ %	4½ %	4½ %	98 —101	98 —101	..	..	..	4 9 1
80,000	Edmundson's Electric Corporation, Ord. Shares.	5	Nil	Nil	Nil	..	⅛ — ¼	⅛ — ¼	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	Nil	Nil	Nil	..	1½ — 2	1½ — 2	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	72 — 75	73 — 76	74½	..	+1	5 18 5
$8,155,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	5 %	5 %	..	82 — 84	82 — 84	..	..	..	5 19 1
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	..	4⅜ — 4⅝	4⅜ — 4⅝	..	..	..	5 12 10
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	..	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	4 11 11
94,350	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	99 —102	97 —100 xd	102½	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	8½%	8½%	8½%	..	6⅞ — 7⅛	6⅞ — 7⅛	..	..	..	5 19 4
$1,526,500	Kaministiquia Power Co., 5 % Gold Bnds.	100	..	5 %	5 %	..	101 —103	101 —103	..	..	..	4 17 1
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	8 %	8 %	..	6½ — 6⅝	6½ — 6⅝	..	..	..	5 18 6
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	93 — 95	93 — 95 xd	..	..	..	4 4 8
111,000	London Electric Supply Corporation, Limited, Ord.	3	2½ %	3 %	2 %	..	1⅝ — 2	1⅝ — 2	..	..	..	3 0 4
90,000	Do. do. do. 6 % Pref.	5	6 %	6 %	6 %	..	4⅝ — 5⅛	4⅝ — 5⅛	5⅛	..	+ 1/16	5 14 3
387,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4½ %	4 %	4 %	4 %	90 — 93	90 — 93	90	..	..	4 6 0
200,000	Metropolitan Electric Supply, 1 to 100,000	5	6¾ %	5 %	5 %	..	4½ — 4⅝	4½ — 4⅝	90/7½	..	..	5 5 8
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½ %	4½ %	4½ %	..	4 1/16 — 4 1/8	4 1/16 — 4 1/8	88/1½	..	..	4 10 2
250,000	Do. 4½ % 1st Mort. Deben. Stock	Stock	4½ %	4½ %	4½ %	4½ %	100 —103	100 —103	..	..	..	4 7 5
248,000	Do. 3½ % Mort. Deben. Stock Redeem.	Stock	3½ %	3½ %	3½ %	3½ %	82 — 85	82 — 85	..	..	..	4 1 5
$5,929,600	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	100	5 %	5 %	5 %	5 %	87½ — 88½	88⅞ — 89⅞	89½	87 11/16	+1½	5 11 5
$18,585,000	Do. Light and Power Co., Ltd., Common	$100	4 %	3½ %	4 %	..	88¾ — 90½	92 — 94	93⅞	89	+3⅛	4 5 1
$5,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	7 %	7 %	..	108 —110	109 —111	110⅜	108⅞	+1	6 6 2
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	100	..	5 %	5 %	5 %	95⅞ — 96⅞	96⅞ — 97⅛	97⅛	96⅛	+ ⅛	5 2 10
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	96 — 98	96 — 98	..	..	..	4 11 10
180,491	Newcastle-on-Tyne, 1 to 187,500	5	8 %	2½%	4 %	..	3⅞ — 4⅛	3⅞ — 4⅛	..	..	..	2 12 9
187,500	Do. 5 % Pref., 1 to 187,500	5	5 %	5 %	5 %	..	4⅜ — 4⅝	4⅜ — 4⅝	..	..	..	5 2 7
150,000	{North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,500}	100	..	..	5 %	..	97½ — 99½	97½ — 99½	..	..	..	5 0 6
10,852	Notting Hill Electric Lighting	10	7½%	7 %	7½%	..	11½ — 12½	11½ — 12½	..	..	..	5 12 0
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 ..	7 %	..	6½ — 6⅝	6½ — 6⅝	..	..	..	5 3 8
120,000	River Plate Elcty. Co. Ord.	Stock	6 %	8 %	9 %	..	228 —238	228 —238	..	..	..	3 15 8
100,000	Do. do. 6% Non Cum. Pref.	Stock	6 %	6 %	6 %	..	103 —113	103 —113	..	..	..	5 6 2
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	101½ —103½	101½ —103½	..	..	..	4 16 7
40,000	St. James' and Pall Mall Electric Light, Ord.	5	10 %	10 %	10 %	..	7⅞ — 8	7⅞ — 8⅛	8⅛	..	+ ⅛	6 1 3
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	..	6⅞ — 7⅛	6⅞ — 7⅛	7	..	..	4 0 6
150,000	Do. do. 3½ % Deb. Stock Red.	100	3½%	3½%	3½%	3½%	85 — 87	85 — 87	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	Nil	Nil	Nil	Nil	1⅞ — 2⅛	1⅞ — 2⅛	..	..	..	Nil
65,000	South London Electric Supply, Ord.	4	4 %	5 %	5 %	..	3 — 3⅜	3 — 3⅜	66/3	..	..	5 19 5
100,000	Do. do. 5 % 1st Mort. Deb.	100	..	5 %	5 %	5 %	99 —102	101 —104	..	..	+2	4 16 3
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	Nil	..	3/32 — 1/8	3/32 — 1/8	..	..	..	Nil
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	..	29/32 — 1 1/32	29/32 — 1 1/32	..	..	..	6 16 7
240,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	..	..	..	4 10 11
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	¾ — 1	⅞ — 1	..	..	+ 1/16	20 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	1½ — 2½	1½ — 2½	..	..	..	11 2 0
271,700	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	80 — 84	79 — 83	..	..	—1	5 7 2
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 808,000	1	..	5 %	..	..	3/32 — 7/32	25/32 — 27/32	..	..	..	5 14 3
110,000	Westminster Electric Supply, Ord.	5	10 %	10 %	10 %	..	7⅞ — 8⅛	7⅞ — 8⅛	7⅞	..	..	6 1 3
81,979	Do. do. 4½ % Cum. Pref. (Reduced from 5% since 31st Dec., 1906)	5	4½%	4½%	4½%	..	5 — 5⅛	5 — 5⅛	..	..	..	4 8 9

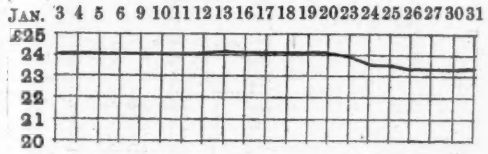
* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 4 per cent. January 26th, 1911.

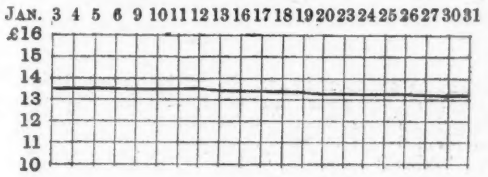
METAL MARKET.

Fluctuations in January.

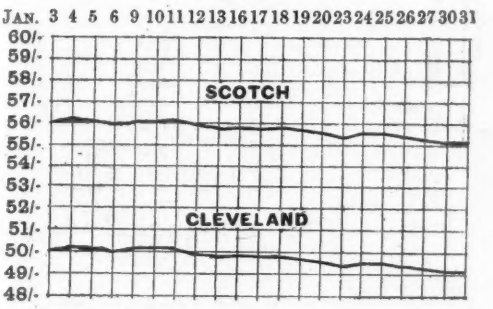
SPELTER (G.O.B's.).



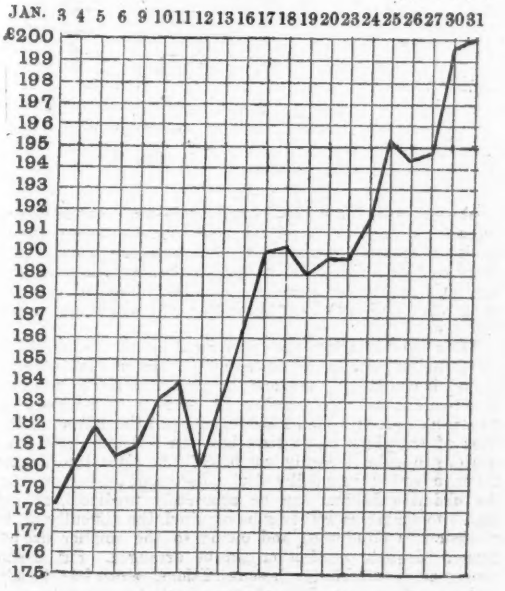
LEAD (ENGLISH).



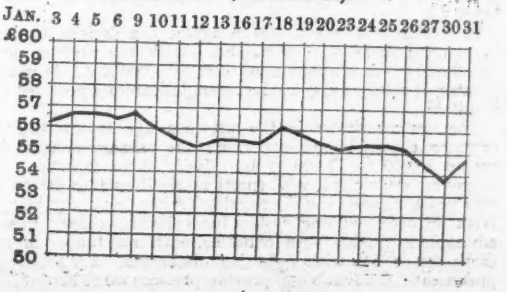
IRON.



TIN.



COPPER (G.M.B's.).



PROCEEDINGS OF INSTITUTIONS.

Static Sub-Station Design.

By P. V. Hunter, A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Newcastle, January 16th*, 1911).

The ways in which transformers and switchgear may be arranged with relation to one another are practically infinite, and nearly every way has something to recommend it. As it is impossible to deal with the whole question within the limits of a single paper, attention will be confined more particularly to the arrangement of buildings and plant.

From the point of view of the supply system, sub-stations must be considered as switching centres for the high-tension transmission system. It is essential therefore that the switchgear be constructed not solely to suit the sub-station plant, but to meet the conditions imposed by the magnitude of the system and future developments. An important matter in this connection is the provision of regulating apparatus for controlling the loading of individual high-tension feeders.

With naturally cooled transforming plant the minimum cost per kilovolt-ampere is reached when the size approaches 1,000 K.V.A. Fig. 1 shows the cost per kilovolt-ampere plotted against size of unit for three-phase transformers wound for 5,500/440 volts 40 cycles, and may be regarded as typical.

The cost of high-tension switch panels is practically proportional to the voltage, and more or less independent of the full-load current within working limits.

Compared with the complete equipment the cost of the building is a relatively small percentage, and therefore it is generally

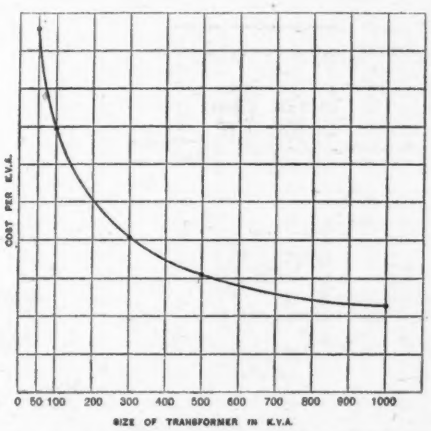


Fig. 1.—Relation between Size of Transformer and Cost per Kilovolt-Ampere.

possible to consider buildings entirely on their engineering merits. A satisfactory design must be capable of ready extension to meet future possibilities.

Sub-stations containing artificially cooled transformers are used only for large powers, where the saving in capital expenditure justifies the cost of attendance. In the first instance, therefore, the naturally cooled type will be considered, as the conditions are more variable and the problem more complicated.

The guiding consideration is maintenance of supply. Four principles may be regarded as essential: (1) The use of sound and properly designed apparatus; (2) the use of automatic devices for isolating faulty apparatus; (3) the maintenance of a sufficient reserve of plant; (4) an arrangement preventing consequential damage and facilitating maintenance. The first two of these items do not materially affect the general design of building but the others are all-important factors.

The provision of reserve plant involves the division of the equipment into similar sections, so proportioned that in the event of the failure of one section, there will be sufficient plant left to deal with the load. In estimating the maximum load to be carried by a particular combination of sections account may be taken of the overload capacity, provided spare plant is kept available in the stores to limit the period of overload. Each spare may, of course, serve for a number of sub-station equipments.

Assuming one section as reserve, at first sight it would appear that the larger the number of sections, the more economical the arrangement. Actually, due to the falling cost per kilovolt-ampere with increasing size of transformer, the reverse is the case, as may be seen from the curve in fig. 1. For a 1,000-K.V.A. load, two transformers of 1,000 K.V.A. each are cheaper than three of 500 K.V.A., and at the other end of the curve two 100-K.V.A. transformers are cheaper than three of 50 K.V.A. Further, as the larger number of transformers require more switchgear, the balance is still more in favour of the smaller number of sections. Above 1,000 K.V.A., the balance begins to turn in favour of increasing the number of sections.

The most important requirements in the arrangement of sub-stations are protection from consequential damage and ease of maintenance. Fortunately, these two requirements are almost

identical in their effect on the problem. In general, the requirements of satisfactory maintenance may be met by providing screens or guards between sections. Protection from consequential damage requires that these screens shall, in addition, be made fire and explosion proof. In practice, the most convenient form of fireproof screen is brickwork or concrete.

The initial step towards the ideal in the design of sub-stations is to adopt an ordered lay-out in which not only is the main apparatus arranged in a systematic manner, but also the various connections between apparatus are run as directly as possible without crossing, and those belonging to each section of the equipment kept entirely separate. A simple design of this kind is shown in fig. 2, a small sub-station erected in 1904 containing two 100-K.V.A. air-cooled transformers.

No serious attempt has been made to guard against the fire risk, and to protect the workmen during maintenance operations it is necessary to use removable screens. The design is therefore suitable for small transformers of the air-cooled type only. With three sections it would be necessary to make very special provision in order to gain proper access to the middle transformer. It is desirable, therefore, for large powers, to modify the design of the building. A two-storey construction has been found very convenient, and has the advantage of reducing ground space to a minimum. Fig. 3 shows a sub-station built in 1904 for a maximum

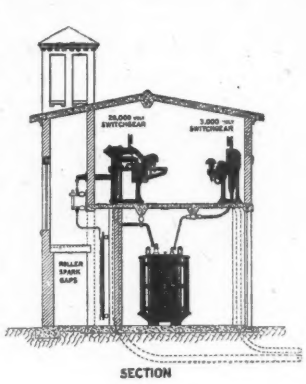


FIG. 6

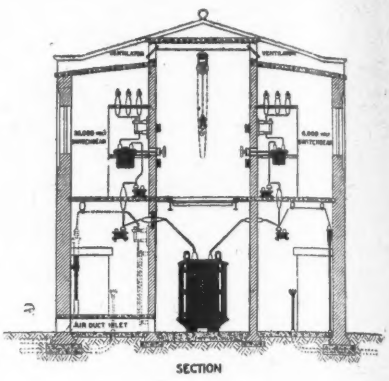
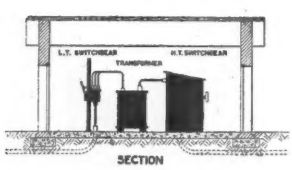


FIG. 7.



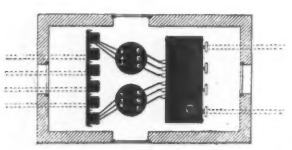
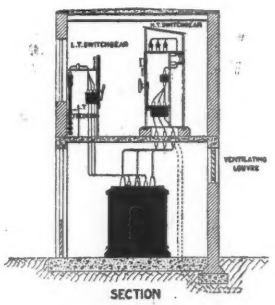


FIG. 2.



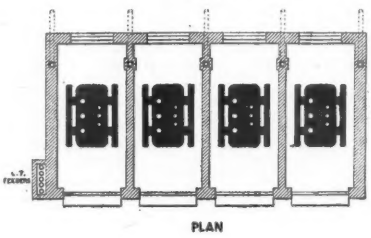
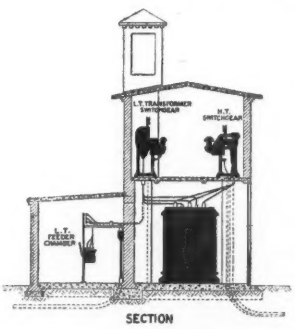


FIG. 3.



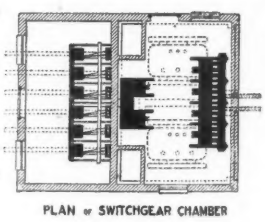
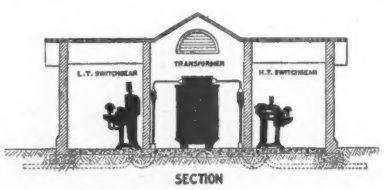


FIG. 4.

load of 3,000 K.V.A., with oil-cooled transformers. This arrangement disposes of the difficulties noted in connection with fig. 2. The fire risk has been to a large extent met by placing the transformers in fireproof cubicles. The connections between apparatus are also satisfactory from the point of view of consequential



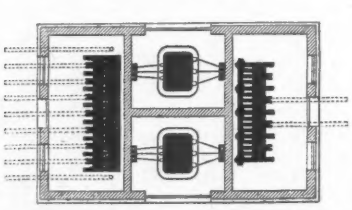


FIG. 5.

damage. One disadvantage is the bunched arrangement of the low-tension outgoing feeder cables, which have to be racked on the wall at the back of the low-tension switchgear and taken out of the building at the ends.

A serious consideration which arises with transformers of moderately large outputs is the necessity for ventilation. The ventilating apertures in fig. 3 do not induce a sufficient draught. Special ventilating flues can be provided for creating a draught through the transformer chamber, the air being admitted through louvres in the bottom half of the door. It is important that sheet-iron should not be used for flues unless special precautions are taken to prevent loss of draught through radiation. In the arrangement indicated in fig. 4 the low-tension feeder switches are located in a special chamber. In the case of a sub-station on a consumer's premises, this enables him to operate these switches without entering the high-tension chamber. It also admits of the consumer using a switchboard of any particular type which may suit his convenience.

While the sub-station shown in fig. 4 meets the requirements of sound design assumed to be essential, before dimensions can be settled, it is necessary to know the maximum size of transformer to be accommodated. As pointed out, there is no economy in using transformers larger than 1,000 K.V.A., and the difference in dimensions of transformers in sizes between 300 and 1,000 K.V.A. is so small as to make it hardly worth while to alter the dimensions of the chamber for the smaller sizes. For small loads, however, where the ultimate demand can be accurately predicted, as not more than two chambers will ever be required, the difficulty of building extensions is eliminated, and owing to the smaller size of transformer adequate ventilation can be arranged. Fig. 6 shows one arrangement suitable for these conditions, which has the advantage over fig. 2 that possibility of consequential damage is reduced and ease of maintenance is obtained. A convenient distinction between figs. 4 and 5 is to adopt the latter for loads that will never exceed 500 K.V.A.

Increasing load may be met in any of the designs by replacing the transformers by larger ones. With the designs shown on figs. 3 and 4, when a maximum size of 1,000 K.V.A is reached, the number of sections may be increased indefinitely provided the site is suitable.

The designs shown in the previous figures are intended for underground cable systems where the primary pressure does not exceed 10,000 to 12,000 volts. Under these conditions pressure surges are seldom met with (particularly if turbine-driven generating plant is used), and discharging devices have not been shown. With an overhead line system for a similar primary pressure it is advisable to provide horn arresters, with resistances in series to earth, for dealing with lightning discharges. For higher primary pressures it is advisable to provide pressure surge arresters on each

feeder panel, and fig. 6 shows an arrangement similar to fig. 4 to meet these conditions. The arresters here shown are ordinary roller spark-gaps with resistances in series.

In the design of sub-stations for artificially-cooled transformers, the chambers may be built to suit the size of transformers installed initially, and the ventilating difficulty is eliminated.

Fig. 8 shows a step-up sub-station accommodating 12,000 K.V.A. of transforming plant, divided into four sections of 3,000 K.V.A. each. The transformers are oil insulated and water cooled, the heat being extracted by means of a special cooler (through which the oil

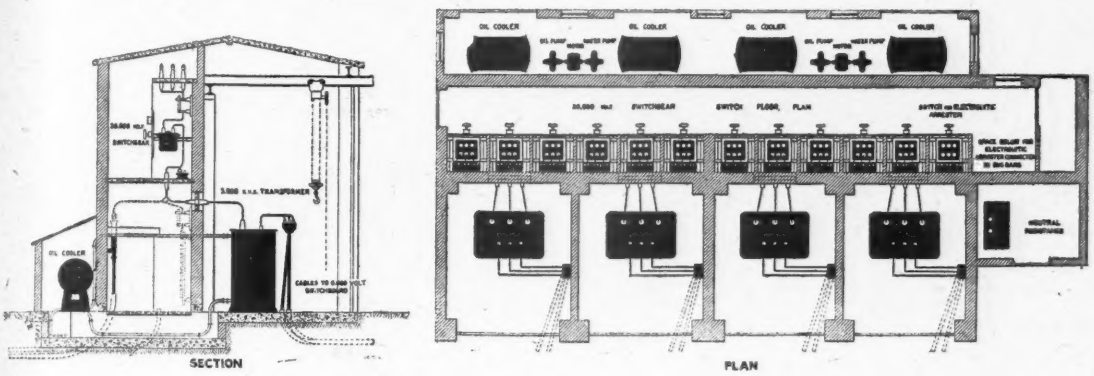


Fig. 8.

and water are pumped) placed in the lean-to at the side of the building. Switchgear for one side only of the transformers is shown in the design, the other side being controlled by switchgear placed in an adjoining power station. This sub-station differs from previous examples, in that provision has been made for lifting the transformers inside the building. In the case of 3,000 K.V.A. units weighing upwards of 25 tons, this is essential for minor repairs and for periodical examination of the transformer.

An interesting arrangement of sub-station which does not fall entirely within either of the two types arbitrarily assumed is indicated in fig. 7. These sub-stations have been installed at the junction points of the trunk mains on a 20,000-volt system, where the energy is transformed to 6,000 volts for general distribution. They have, therefore, extremely important duties, and it is impossible to estimate the ultimate maximum load. In these circumstances the sub-stations are designed with each section suitable for naturally cooled transformers up to sizes of 1,000 K.V.A., but may be arranged to accommodate artificially-cooled units up to 3,000 K.V.A. each. As an attendant is necessary on account of switching operations, he can give the necessary attention to the transformer cooling plant. A crane is provided for lifting the transformers.

The author does not claim any special merit in the designs here shown, except that they are a consistent interpretation of the principles assumed to be essential at the commencement of the paper.

Discussion.

Mr. J. A. Anderson (Newcastle Electric Supply Co.) said that in the past sub-stations had been designed mostly by rule of thumb, and then redesigned after the weak points had been discovered. It required considerable experience to judge of the amount of ventilation one was likely to get in a given design, and in many cases it looked as if the transformers were put in cubical boxes and left to look after themselves. The design shown in fig. 8 had not been tried, and in view of the absence of experience with coolers, he suggested that it would be better to spend the money on larger transformers. Fig. 7 showed a design giving poor ventilation, and the transformers got too hot.

Mr. H. L. Risely (N.E.S. Co.) said that Mr. Hunter had forgotten to mention the inaccessibility of the average sub-station. It was highly important that transformers should be capable of being put in or taken out in the minimum time; and not only was the site of importance, but provision should be made for handling heavy weights. He suggested the provision of a crane on the outside wall or roof. The flat roofs shown were difficult to make watertight with concrete, and the addition of asphalt increased the cost considerably. In America the water-cooled transformer was not making great progress, while the air-cooled type was very popular.

Mr. C. Turnbull (Tynemouth Corporation) said that he was struck by the immense cost of distributing energy by a large company, and he thought that a table showing the distribution costs per unit for the various supply concerns in the country would be interesting. Some of the London stations were said to lose as much as one-third of their total output in distributing losses, and he wondered if these immense losses could allow of large companies supplying as cheaply as one could generate on the spot.

Mr. E. Fawcett (N.E.S.Co.) said that the Supply Co. lost 10 million units in transformers per annum. In fig. 2 design, the metering would be somewhat difficult, and two current transformers would be necessary. In considering the ventilation of sub-stations, the absorbing power of the brickwork was often overlooked, and in several of the designs shown, the direction of the wind had a great influence on the ventilation. He questioned the advisability of using roller spark-gaps for 20,000 volts, as shown in fig. 6. These had to be set for a large voltage rise on account of the big ratio between the sparking over and quenching values. He also asked for information as to the real action of horn arresters. The old hot-air theory had been attacked by Mr. Peck recently, who showed that the effect was purely magnetic, but some of his own experiments went to prove that there was a good deal in the action of the hot air, after all.

Mr. C. Vernier (N.E.S. Co.) said with regard to fig. 3, the bunching of the cables was entirely on account of the site of that particular sub-station, and if the high and low-tension switchgear had been transposed, the low-tension leads could have been brought out through the back wall. Further information regarding the various cooling systems would be useful; the air-blast system had not even been mentioned.

Mr. A. G. Shearer (N.E.S. Co.) advocated the use of single-phase transformers, as one single-phase transformer only need be kept as a spare, and no spare switchgear was required. There would be a distinct saving in capital cost and in the cost of energising.

Mr. H. W. Clothier (Reyrolle & Co.) said that if invited to say what sub-stations would be like in 10 years' time, he would prophesy that the whole of the gear would be placed in the open with a fence round it. The existing designs of ironclad switchgear were such that they would take no harm by being in the open; the transformer ventilation would be perfect, and the objection of expense which had been raised against the designs shown in the paper would not apply. Further, there would be no loose cables, as all the movable parts could be made to plug into place. In short, everything would be covered with iron, and placed in a field.

Mr. W. W. Wood (Scott & Mountain) mentioned that horn arresters appeared to be in favour for overhead lines, and spark-gaps for underground cables. At Harton Colliery horn arresters were used exclusively, and these seemed to favour Saturday afternoons for sparking over.

Mr. H. R. Viall (N.E.S. Co.) said that Mr. Clothier's suggestion had been forestalled at the Ponteland sub-station of the Supply Co., where a small transformer was actually working in the open.

Mr. P. V. Hunter, in reply, considered fig. 8 the most critical design shown, in view of the lack of experience with coolers. Before deciding between natural and artificial cooling, cost had to be considered. In the case of fig. 8, naturally cooled plant would have multiplied the cost by two. He preferred natural cooling, but there were difficulties in carrying this out in every case. There was little probability of leakage in the coolers. The makers had given most rigid guarantees. The reason for adopting the flat roof was for ease in extending and also in supporting the roof. It was found to be impossible to cut the cost without at the same time sacrificing essentials. In the case of fig. 7 the station was a centre which was fed at 20,000 volts and distributed to other sub-stations at 6,000, so that one could not afford to take any risks. The metering difficulty in fig. 2 could easily be got over by using double bus-bars, and this would be cheaper than two current transformers. He had not much faith in roller spark-gaps, but they had been installed, under guarantee, by the makers in the first place, and had simply been added to. The cost curve shown in fig. 1 held good for different voltages, but, of course, to a different vertical scale.

Mr. Clothier's suggestion regarding outside sub-stations was fairly feasible except for the transformers, the makers of which were not so enterprising as the switchgear people. Horn arresters were, perhaps, unreliable, but they were better than nothing.

Modern Electrical Dock Equipment.

By W. Dixon and G. H. Baxter.

(*Abstract of paper read before the* Institution of Mechanical Engineers, *January 20th*, 1911.)

The authors fully appreciate all the merits of hydraulics, and that this form of power is, perhaps, under favourable conditions, not inferior to electric power. Where, however, in addition to reliability, economical working together with cleanliness and great flexibility is desirable, the inherent advantages of electricity at once become apparent. Prior to recent electrical developments, there were undoubtedly cases in which hydraulics had a distinct preference over electricity, *e.g.*, in the shipment of coal either by cranes or by tips. This particular difficulty, however, has now been overcome, and electricity will occupy at least as important a place

as hydraulic power in all future developments of docks. Since the electrical and mechanical parts have received combined consideration, the past few years' experience has proved that electrical plant is quite as reliable as hydraulic plant.

Rothesay Dock, situated on the Clyde, and belonging to the Clyde Navigation Trustees, is designed essentially for dealing with the shipment of coal, and the import of iron ore, limestone and other materials.

The results obtained from an electric crane at Princes Dock, which had been erected for the purpose of comparing the relative advantages of the two systems, were so favourable that no doubt was left as to the advantage of dealing with the ordinary class of machines, such as cranes, capstans, &c., electrically. The proposed installation of several large coal-hoists, however, rendered the problem one which had not hitherto been faced, owing to the difficulty of dealing electrically with the large amount of horse-power required in a very short period, together with the necessity of providing for rapid acceleration and retardation, and absolute control under all conditions.

It appeared to the authors that the difficulties were not insurmountable, and they proceeded with the construction of two hoists, which have now been in operation for over three years, have given no trouble, and have more than fulfilled the duties expected from them. In fact, so satisfactory have the results been that the two additional hoists now being erected will be, in all essentials, a repeat of the existing ones, differing only in some minor details.

From fig. 1 it will be seen that the appliances already erected consist of two 32-ton coal-hoists: 18 4-ton cranes; 27 1-ton capstans; two 18-ft. tipping turntables; two 5-ton pier-head capstans; an underground distribution system, and an electric lighting installation, in addition to which two 32-ton coal-hoists and turntables, two 4½-ton transporters, three 4-ton cranes, and 12 capstans are in course of construction.

Where a reliable public power supply is available, it is desirable to take advantage of such a supply, and so obviate a considerable capital expenditure. In many cases, however, the supply available is on the three-phase alternating-current system, which is not so suitable for dock purposes as direct current. Such a supply being

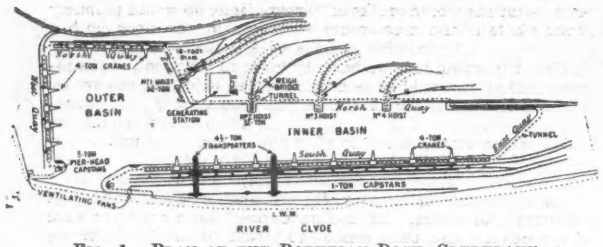


FIG 1.—PLAN OF THE ROTHESAY DOCK, CLYDEBANK.

available at Rothesay Dock, the advisability of adopting it received due consideration, but the alternative of a separate generating station was deemed to offer the best solution, it being found that power could be generated to better advantage at a lower cost by plant specially designed for the purpose.

The generating station is situated in a convenient central position on the North Quay of the Inner Basin.

The steam-raising plant consists of two water-tube boilers, with integral superheaters and chain-grate mechanical stokers. The feed-water is partially heated by the exhaust steam from the feed-pumps in a feed-water heater, and passes to an economiser of 190 tubes in the main flue. The steam passes through two grease-extractors on its way to the surface condensing plant, which comprises two complete sets.

As the intermittent working of dock machinery causes excessive peak demands, it has hitherto been the invariable practice to install a battery of accumulators with a reversible booster plant in connection with dock installations. In this case it was decided to investigate the possibilities of further developing the system of coupling a prime-mover to a generator in conjunction with a fly-wheel.

The principal problem to be solved in this arrangement was to ensure a constant voltage at the terminals of the main generator supplying power for ordinary purposes.

The combination eventually designed consists of a specially arranged high-speed engine of the triple-expansion type, capable of developing about 450 B.H.P. as a normal load, at any speed between 320 and 375 R.P.M. Direct coupled to the crankshaft of this engine is a continuous-current main generator, capable of generating current at a constant voltage irrespective of speed and load; this generator, which has a normal output of 340 E.H.P., with a considerable overload capacity, is used for supplying power to the ordinary dock appliances. The requisite voltage regulation is attained by means of a small machine belt-driven from the main shaft. The end of the main generator shaft is extended to take a special flexible coupling, by means of which it is coupled to the fly-wheel shaft, on which is mounted the fly-wheel and two coal-hoist generators. In designing the plant, it was intended that the storage of power in the fly-wheel should be such that, with both hoists working with full load and to full height, the average demand from the engine should not exceed its normal rated power. By trial it was ascertained that these conditions were fulfilled, and that, even with the main generator loaded to about 63 per cent. of its normal output, in addition to the hoists working as above, the demand only slightly exceeded the normal output of the engine with a drop in speed of the combination of about 20 per cent.

The fly-wheel is entirely enclosed in a cast-iron case, the object of providing this being that, should the power required to maintain the fly-wheel and two hoist generators at normal speed prove excessive, the former could be run in vacuum; but, as the power required was only about 20 E.H.P. when running at the maximum speed of 375 R.P.M., the installation of the necessary gear for producing the vacuum was considered quite unnecessary. The above power is only consumed when the coal-hoists are in operation; under ordinary working conditions, considerable economy is effected by disconnecting the fly-wheel when the engine and main generator run as an ordinary generating plant.

Two sets are at present installed, and foundations provided for a third, which is now in course of construction; for times of light load and for week-ends a direct-coupled set of 120 KW. is provided. A small steam-driven exciter furnishes the necessary excitation

FIG. 2.—ELECTRICAL COAL HOIST.

current. The main switchboard consists of 20 panels of enamelled slate; switchgear is also erected under the switchboard gallery, by means of which it will be possible to connect any one of the four coal-hoists to any one of the six coal-hoist generators.

At present there are two coal-hoists, each being of the high-level and fixed type; the loaded wagon is run on the tipping platform at the quay-level, raised to the required height and tipped, after which the empty wagon is lowered to the high-level inclined viaduct, leaving the hoist at a height of about 17 ft. from the ground, and gravitating to the siding, the cradle then being lowered to the ground-level to receive the on-coming loaded wagon. Fig. 2, which is a general view of Hoist No. 1, shows the construction. Each hoist is capable of raising, tipping, and lowering wagons carrying 20 tons of coal, with a gross weight of 32 tons, as well as those of the ordinary type at present in use holding 6 tons and upwards.

After careful consideration of the cycle of operations necessary to ship the maximum quantity of coal under the system of coaling generally in vogue at docks on the Clyde, where end-tipping wagons are used, it was decided to adopt a mean hoisting-speed, allowing for acceleration and retardation, of about 100 feet per minute with full load, corresponding to a time of 30 seconds for the full height of 50 ft.; this speed, with a full unbalanced load and a combined mechanical and electrical efficiency of 72 per cent., being equivalent to about 300 E.H.P. in the motor.

Perhaps the most difficult motion of a coal-hoist to deal with electrically is the tipping, as this has to be accomplished very expeditiously through a comparatively short distance, usually a maximum of 45°, and with a degree of accuracy very difficult to attain under such varying conditions and loads. To tip the full wagons to a maximum angle of 45° in six to nine seconds requires power almost identical to that for hoisting, so that the motors for the two motions are duplicates.

It will be seen that the design of the structural work and arrangement of shoot, jib-cranes, and other auxiliary apparatus is on usual lines, the essential difference being that all the gearing is at the top of the structure, which has been designed to carry this additional weight.

The hoisting motor drives, by means of an elastic coupling and also an ordinary jaw-coupling, and spur gearing, a countershaft geared to the hoisting drums. The whole of the gearing, with the exception of the motors, is erected upon a cast-iron bed-plate, and both motors are mounted upon one base-plate, which is bolted to the gearing base-plate. For the purpose of taking up the slack of the tipping rope during the raising of the platform, a third drum is connected to one of the hoisting drums. The tipping motor is a duplicate of that for hoisting, and the gearing generally is similar, except that only one drum is employed

The brakes for both hoisting and tipping are of the friction clinch type, the brake-bands being kept tight during the hoisting, and the clinches revolving freely in the hoisting direction. By this means the load is held in suspension immediately power is disconnected from the motor. In lowering, the brake-bands are released by electro-magnets in the usual way. Due to the fact that the hoisting and tipping motors are duplicates of each other, it has been possible to provide a simple arrangement by means of which one motor can work both motions in case of breakdown to either motor, thus enabling coaling to be proceeded with and avoiding any serious delay in the departure of a vessel.

The whole of the control is arranged from the attendant's cabin, situated near the top of the hoist. There is only one control-lever, which works in a quadrant or frame, and, by moving this lever in the various positions, the attendant has control of the hoisting, tipping and jib crane, the only other controller being a small one for controlling the slueing of the jib-crane. Gearing is arranged in connection with this control-lever frame, which automatically renders it impossible for any of the motions to exceed their predetermined efforts, and it is also impossible for the attendant at starting to move the lever at such a rate as to accelerate at too great a speed and consequently throw an undue load upon the generating station. In fact, at all points of possible danger, the automatic adjustments come into operation, and prevent any damage from error of omission or commission on the part of the attendant. In actual working, it has been found that the cradle can be brought to rest quite smoothly at any desired position, and in a similar manner the tipping platform can be quite smoothly stopped at any desired position. The wagons while on the hoist and when being run off are thus protected from the rough usage to which they are frequently subjected during coaling operations.

The results tabulated below, which were obtained in February, 1909, after two years' working, show that the time required for coaling through the cycle of operations is considerably shorter than that specified.

At the official trials in May, 1907, when the hoists had done practically no coaling under actual working conditions, the following readings were taken upon hoist No. 2 :—

Total unbalanced load ...	32 tons 0 cwt. 1 qr.
Height lifted	60 ft.
Time hoisting	36 seconds.
Speed of hoisting	100 ft. per minute.
H.P. due to load	217·3 load H.P.
Current	500 amperes.
Voltage	450 volts.
Electrical horse-power ...	301·6.

Details of actual cycle of operations.	Gross weight.		
	T. C. Q. 16 5 2	T. C. Q. 18 6 0	T. C. Q. 28 3 0
	Sec.	Sec.	Sec.
Securing wagon on cradle and raising to a height of 57 ft.	30	30	31
Tipping loaded wagon	8	8	9
Lowering platform with empty wagon to cradle chamber	6	6	6
Lowering cradle with empty wagon to high-level viaduct	24	24	24
Uncoupling and running wagon off ...	8	8	8
Lowering empty cradle from high-level viaduct to ground	12	12	12
Total time per cycle... ...	88	88	90
Times specified	100	100	103

These readings show a combined efficiency of 72 per cent., which figure is within that guaranteed by the contractors.

During the coaling of a ship on February 10th, 1909, several ampere and voltage diagrams were taken. Fig. 3 is a typical example of these diagrams, and represents a complete cycle with a wagon of gross weight of 16 tons 17 cwt., containing a net weight of coal of 10 tons 10 cwt.

These readings show a combined efficiency of 80 per cent., including distribution losses. This result shows that the efficiency of the hoists had considerably improved during the two years' working, and, as it was obtained at half-load, further clearly demonstrates the high efficiency of electricity over wide ranges of working, a condition impossible of attainment with hydraulic power.

Due to the above, and the other inherent advantages of electricity in actual working, the results obtained have been most satisfactory, and compare very favourably with hydraulic hoists, notwithstanding that the conditions of working up to the present have not been conducive to the most economical results, as, although the hoists are constructed to deal with the largest wagons which will eventually come into general use, only comparatively small ones are at present available.

The total coal and other material shipped by the two hoists during the 12 months was 556,419 tons. The units consumed during this period was 80,164, and the number of wagons dealt with 70,604. During this period as much as 23 tons of coal per unit has been shipped, while, including all distribution losses and also the power necessary for the working of all auxiliary apparatus in the hoist, including the jib-crane, adjusting of shoot and shoot point, &c., the energy consumed over the whole period only averaged one unit per 6·94 tons of coal shipped, although there was an average of only 7·88 tons of coal per wagon.

The results of the test on February 10th, 1909, show that the consumption of energy for coaling by electric hoists, including distribution losses, is 0·131 unit per ton of coal shipped when

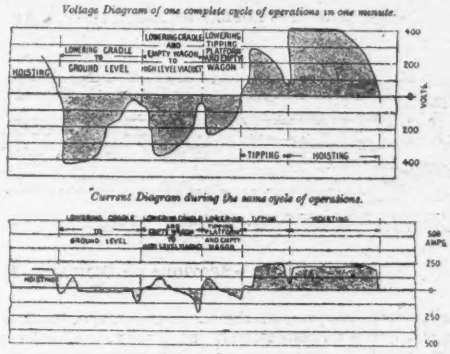


FIG. 3.—VOLTAGE AND CURRENT DIAGRAMS OF COALING CYCLE.

working to a height of 46 ft. This at 1d. per unit is equivalent to 10s. 11d. per 1,000 tons of coal shipped. For coaling by hydraulic hoists the consumption has been shown to be 25,220 gallons of water, which at 9d. per 1,000 gallons is equivalent to 18s. 11d. per 1,000 tons of coal shipped, showing a saving of 8s. per 1,000 tons in favour of electricity.

The result of two years' working shows that the cost of upkeep has not exceeded, and is not likely to exceed, that required for the upkeep of coal-hoist plant operated by hydraulics or steam.

(To be concluded.)

EXPANSION CABLE JOINTS.

SUPPLY undertakings operating in mining and other districts, where subsidences or earth movements are likely to occur, frequently experience serious trouble with their mains, owing to the pulling out or collapsing of cable joints, followed, of course, by interruptions in the supply, due to the breaking down of the cable insulation or an actual break in the conductors. Fig. 1 illustrates a typical case of breakdown, due to the above cause. The cable cores will be seen to be very much bent and distorted, and forced against the lead sleeve, which is not similarly buckled. The lead sheath, as a rule, gives no trouble, as it stretches or thickens up and corrugates, according to the direction of the movement.

Again, in three-core and concentric cables, the several conductors are frequently found to move independently of one another and also of the lead sheath, and although it is in some cases the practice to lay the cable direct in the ground with slack, it has been found

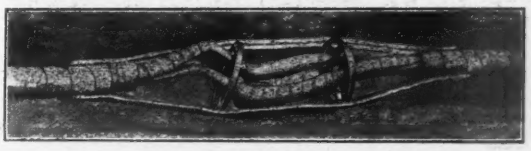


FIG. 1.—JOINT BUCKLED THROUGH EXPANSION.

that this in itself is not always sufficient to prevent the above trouble. Snaking or waving the cable in the ground merely minimises the trouble, while, of course, the extra cost, due to the increased length of cable required, is considerable.

Another source of trouble is the heating of mains, due to overloading in emergency, or with a view to economising in copper. This trouble is more likely to be accentuated in future, as existing mains get loaded up, and in view of the temptation to defer laying additional mains until the latest possible moment.

In the case of H.T. and E.H.T. systems where pressure drop can be readily compensated for by transformers, the possible economy in copper is, of course, greatest, and anything which will allow of higher loading on cables and a consequent saving of capital expenditure is welcome.

The safe increase in temperature in three-core paper insulated cables, taking the initial temperature at 60°, is somewhere in the neighbourhood of 90° F., but the expansion of the copper conductors due to this temperature increase necessitates some means for allowing them to move freely without destroying the continuity of the cable at the joints. That this is so is clear when it is remembered that, in a 200-yd. length of cable and for a temperature rise of 90° F., the movement may be as much as 6¼ in., or over 4 ft. 6 in. in a mile

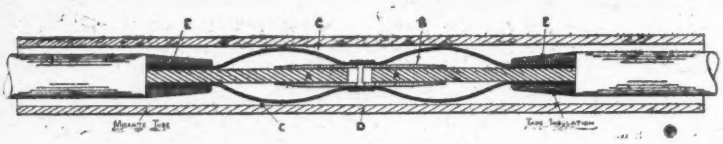


Fig. 2.—Section of Expansion Joint

by insulating tape, and the whole enclosed in a wrought-iron tube, which is closed at the ends by glands, to which the lead covering is wiped, and to which the armouring is clamped by bonding clamps.

The wrought-iron tube is filled with resin oil or a specially soft insulating compound, which when heated will easily run into and fill up every part of the interior, and when

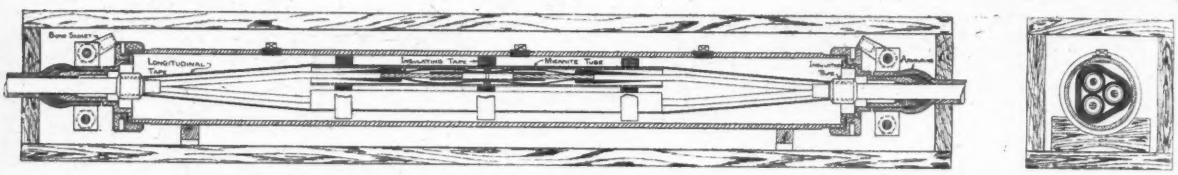


Fig. 3.—Sections of Complete Expansion Joint in Three-Core Armoured Cable.

Under the same temperature rise the lead would have movements of 10 in. and 7 ft. 4 in. respectively, but in practice it is, of course, relatively cooler than the copper conductors due to its larger radiating surface, and as longitudinal movement is prevented by the troughing or soil, the lead merely corrugates or stretches as the case may be. It must further be noted that, if the cables have been jointed in cold weather when the temperature is below 60°, these movements will be very considerably increased.

It will be seen that as this contraction and expansion is continually taking place, although not up to the limits mentioned above, it is

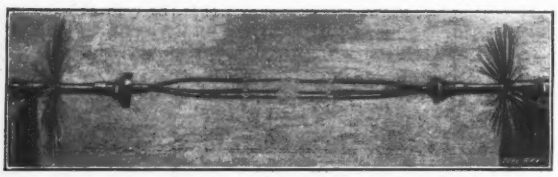


Fig. 4.

important to make some provision for taking up the movements of the conductors, and it may be remarked that electrical cables are perhaps the only examples of engineering work on which no such provision is made under ordinary circumstances.

A joint, which overcomes the difficulties mentioned above, has been patented by Mr. Chas. Vernier, who is mains engineer for

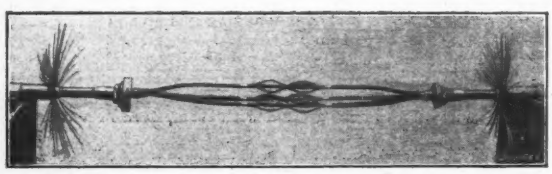


Fig. 5.

the Newcastle Electric Supply Co., Ltd., and we give herewith drawings and a description of this, which we think will be of interest.

The expansion joint consists essentially of a guide tube which slips over the ends of the conductors, and which is bridged by flexible connections made of woven metallic braid, the guide tube

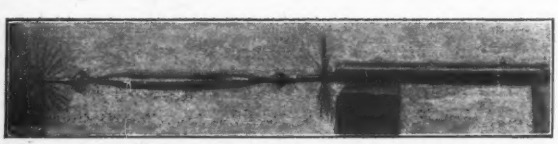


Fig. 6.

thus compelling the conductor ends to move in line with each other, while the flexible connections maintain electrical continuity.

Fig. 2 gives details of one joint, in which A A are the two ends of the cable, B is the guide tube, and C C the flexible braids, which are bound down to the middle of the guide tube, and also to the cable at E E. Each separate joint is contained in a micanite tube D.

Fig. 3 shows a complete joint on a three-core high-tension cable; it will be seen that the three micanite tubes are bound together

cooled will still not be sufficiently viscous to impede the movements of the various parts of the joints.

As in many situations the ground is more or less charged with water and salts which actively attack iron, in such cases it is

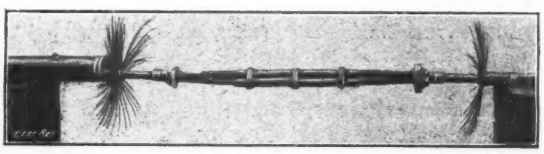


Fig. 7.

advisable to enclose the whole joint in a wood box as shown, which is filled up with pitch before nailing down the lid.

Other figs. illustrate the process of making the complete joint, and fig. 9 shows a similar joint in lead sheathing, while fig. 10 shows a detail of the bonding arrangements.

Fig. 4 shows the armouring cut back as far as necessary, the conductors separated, and the glands slipped on. The iron tube is of

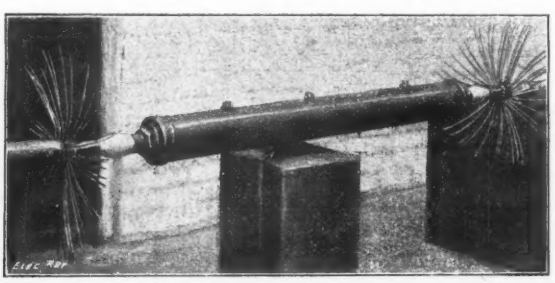


Fig. 8.

course also slipped on to the cable, but is not shown in the illustration. The ends of the conductors are blackened where they enter the brass tubes, in order to prevent them from adhering in the subsequent soldering. The three joints are next placed

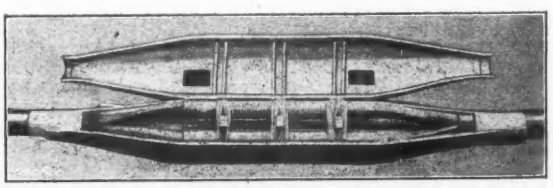


Fig. 9.

in position, and the ends of the braids bound down to the unblackened parts of the strands, and solder is poured over the binding until the joint is solid through and through (fig. 5).

The next process is to split the micanite tubes, and to slip them over the joints, as shown in fig. 6. The tubes are then taped over, and at three points on each the tape is built up to form a separator The longitudinal tapes are also placed in position at this stage. Fig. 7 shows the taping complete, with the longitudinal tapes

bound down to the cable, and it also clearly shows the function of the separating bindings. The tube is now slipped over the complete joint and the end glands are screwed on.

Passing on to fig. 8, in the case of lead-covered cables the joints are plumbed at this stage. After plumbing, tape is applied to the lead covering, in order to bring it up approximately to the same diameter as the serving over the lead, and the armouring is then

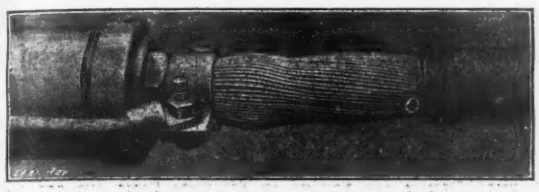


Fig. 10.

laid down on the cable and cut off to length, after which the bonding cable and clamps are applied, as shown in fig. 10. The joint is now complete except for filling up with compound.

Fig. 9 shows one of these joints for 20,000 volts working pressure in a lead sleeve, and it will be noticed that in this case the separators are star-shaped porcelains, instead of coils of tape, as in the previous instance.

Messrs. A. Reyrolle & Co., who are making these joints under licence, have developed a complete line, which includes all sizes from ·025 up to ·25 sq. in. in three-core cable, and suitable for all voltages up to 20,000 in each case, for a 3-in. movement or 6-in. movement, as required.

EARTH CONNECTIONS OF METALLIC POLES FOR OVERHEAD WIRES.

By those engineers whose duties do not include supervising the laying and maintenance of steel poles for supporting overhead wires, the effectiveness of an ordinarily planted steel pole from the point of view of obtaining a good connection to earth of the latter, would hardly be questioned; and it may also be a surprise to many to learn that cases have often been found, even in heavy weather, with the ground well soaked, where the resistance to earth of a deeply-planted pole has been comparatively large.

In tramway practice it is most essential that a good electrical connection of the poles to earth be obtained: otherwise there will always be the possibility of the existence of "live" poles, and claims for damages, real or imaginary, from pedestrians who may happen to touch or walk near a faulty pole.

Most tramway engineers of experience will have had the existence of live poles, at some time or another, brought to their notice, and in many of these cases it is the source of some amusement to the small boy to note how lightly a person steps when his feet and legs come into the live zone, and form a parallel circuit for the current as it leaks from the pole over the surface of the ground.

No such fault has, so far as the writer is aware, been the cause of a fatal accident, but if statistics were compiled, it would most likely be found that the number of claims received on account of this type of electrical accident, and the sums paid in respect thereof, were greatly in excess of what is commonly imagined.

Tramway poles are commonly planted in a hole 6 ft. deep in the ground, and are packed up with a bed of concrete; although the latter is a somewhat poor conductor, the area of contact between pole and concrete, which averages about 1,400 sq. in., would appear to be sufficient to conduct to ground any stray leakage currents from the trolley wire.

A large number of tests have been made to ascertain the effectiveness of such a connection to earth, in which the pole was electrically connected to the live wire through a resistance, so as to allow a heavy current to pass to earth in case the earth connection was of negligible resistance. This simple test provided a ready means of calculating the relative conductance of the earth connection, and owing to its simplicity could safely be left in the hands of unskilled men.

The result of all the great number of cases tested appeared to show that full reliance could be placed on the common method adopted for planting the poles from the point of view of providing a good earth for them, and yet cases keep cropping up now and again of poles becoming "alive."

A "live" pole case of a somewhat serious nature, which occurred on a tramway system, came under the writer's notice some time ago.

The first indication of anything being wrong was given by the startled manner of a horse as he passed along the road between the faulty pole and the tramway rails. Others which followed commenced to prance and kick violently as they passed that particular point, while some bolted and eventually came to grief in one way or another. As may be imagined, onlookers were naturally bewildered at the course of events, and previously to the case presenting a serious aspect, evidently derived a certain amount of amusement from observing how animals of even a slothful temperament suddenly became spirited for no apparent reason. For some few days previously and up to the time of the trouble occurring a considerable amount of rain had fallen, and consequently the roadway was very wet.

The trouble was eventually found to be due to a short having occurred from the lead of an arc lamp to the pole which supported it, the lamp being supplied from mains at a pressure of about 205 volts.

A test made shortly after the occurrence disclosed the fact that when 18 amperes were passed from pole to rail, the difference of potential between the two was 204 volts, from which it may be assumed that at the time of the accident the resistance between pole and rail was sufficient to allow of practically a 200-volt difference of potential between these points being maintained, while limiting the current to a value lower than that necessary to blow the lamp fuse.

With these facts in mind, it is easy to see that as the horse is electrically a very sensitive animal, and makes good contact with the ground through his own shoes, this difference of potential which existed between two points about 10 ft. apart over the road surface was of sufficient importance to constitute a certain amount of danger to vehicular traffic, by reason of the possibility of the forefeet of any quadruped being in contact with a part of the road which was at a much different potential to that part of the road on which the hind feet made contact.

Now, in an ordinary case of breakdown in trolley wire insulation, the current which passes from wire to pole, and thence to rail, is obviously extremely great, and opens the circuit-breakers at the generating station, which, when closed again, sometimes disclose the fact that the arcing set up at the fault has burnt the conducting portion clear.

If, however, the insulation broke down at a point where the earth connection of the pole was similar, or worse than in the previously-mentioned instance, it is quite possible that the resulting current might, by reason of the resistance between pole and rail, be limited to an amount not sufficient to open the station circuit-breaker, yet great enough to create a few hundred volts difference of potential between two points on the road surface—one near the pole and the other near the rail—and thus considerable danger to pedestrians and to vehicular traffic might arise.

It is the practice on many tramway systems to bond all poles which carry feeder or section cables to the rail. Now, if all iron or steel poles were similarly dealt with, there would, of course, be no possibility of a difference of E.M.F. being created, as may happen with an unbonded pole, and it would seem to be a question of no small importance whether it would not be advisable, in the interests of the general public, that all iron and steel tramway poles, especially those which carry lighting or other live cables, be properly bonded to the tramway rails and thus ensure a low-resistance earth connection being obtained.—E.H.C.

Telegraph Rates.—From January 14th a reduction of 2 copecks, or ½d. per word, has been made on telegrams between European and Asiastic Russia.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

SPANISH WEST AFRICA.—Electrical and similar goods imported into the Spanish Possessions in the Gulf of Guinea are admitted free of duty, but the local councils are authorised to collect a tax of 25 peseta per 100 kg. gross weight on general cargo imported (peseta = 9·6d.). Certificates of origin are not generally required for goods imported, the bill of lading being sufficient for the examination of general merchandise in the Customs houses of that colony.

STRAITS SETTLEMENTS.—Electrical and similar goods imported into the Straits Settlements are admitted free of duty.

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

1,091. "Electric time switch." H. F. J. Thompson and J. H. Bowden January 16th.

1,100. "Thermo-electric temperature measuring apparatus." F. Stroude and F. Josephs. January 16th.

1,110. "Telephone switchboards." W. Aitken and British Insulated and Helsby Cables, Ltd. January 16th. (Addition to 1,050, 1910.)

1,113. "Control of electric generators." O. D. Lucas. January 16th.

1,128. "Asynchronous dynamo-electric machinery." M. W. Adam. (Akt-Ges., Brown, Boveri & Co., Switzerland.) January 16th.

1,136. "Electrical resistances." C. D. Kingwell. January 16th.

1,161. "Drawn wires suitable as illuminating bodies for electric incandescent lamps and process for manufacturing same." Deutsche Gasgluhlicht Akt-Ges. (Auerges.) (Convention date, August 13th, 1910, Germany.) January 16th. (Complete.)

1,162. "Manufacture of electric incandescent lamps." H. G. Moller. (Convention date, January 17th, 1910, Germany.) January 16th. (Complete.)

1,177. "Means for actuating the frogs or overhead points of electric tramways and the like." L. Goldingay. January 17th.

1,189. "Electric light watertight lampholder for temporary lighting circuits." M. K. Grany. January 17th.

1,209. "Means for operating electric motors driving motor-trains." W. A. T. Muller. January 17th. (Complete.)

1,210. "Incandescence electric lamps." C. H. Weber. (Convention date, March 26th, 1910, Germany.) January 17th. (Complete.)

1,251. "Incandescent lamp." J. Wilson. January 17th.

1,252. "Process for obtaining rapidly the establishment or the variation of the electromotive force of a dynamo-electric machine and for maintaining the potential difference constant at its terminals." Societe Alsacienne de Constructions Mecaniques. (Convention date January 17th, 1910, France.) January 17th. (Complete.)

1,295. "Overhead electric trolley wires." J. W. Thompson and J. Finnigan. January 18th.

1,302. "Boxes for use with electric cables, telegraph, telephones and the like applicable for other purpose also." H. Dickinson. January 18th.

1,324. "Time control of electric circuits." H. T. Harrison. January 18th.

1,328. "Electric conduit junction-boxes and the like fittings." H. Hirst and T. Taylor. January 18th.

1,333. "Device for operating tramway switches from the conductor stand of the tramcar." K. Wiehle and H. Hellmann. January 18th.

1,335. "Controlling apparatus for electric lifts." A. W. Penrose & Co., Ltd., and F. Barlow. January 18th.

1,346. "Electric signalling apparatus for railways." H. R. Richardson. January 18th.

1,360. "Electrically controlled igniting devices." W. Bale and L. H. Hopkins. January 18th.

1,369. "Electric measuring instruments." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) January 18th.

1,370. "Switches adapted for operating the electric lamps of illuminated signs and the like." F. A. Brown and J. C. Trapagna. January 18th. (Complete.)

1,378. "Method of lubricating armature bearings belonging to tramway motors." C. J. Jewell. January 18th.

1,414. "Electrically-driven hand planing and moulding machine." W. A. Amphlett and A. Schror. January 19th.

1,415. "Electric letter signs." A. Gallanzi and F. Vaysse. January 9th.

1,420. "Exchange apparatus or 'switch' for speaking tubes." R. J. Wentworth (trading as Wentworth & Co.). January 19th. (Complete.)

1,469. "Inverted incandescent gas, electric, and like burners or lamps." Provincial Incandescent Fittings Co., Ltd., and J. Webber. January 19th.

1,481. "Electrical chest warmer." A. Selvatico. January 19th. (Complete.)

1,527. "Electric arc lamps." J. Y. Johnson. (Badische Anilin and Soda Fabrik, Germany.) January 20th.

1,543. "Electric motors." J. C. Crawshaw and Phœnix Dynamo Manufacturing Co., Ltd. January 20th.

1,544. "Electric furnaces." W. C. Heraeus G.m.b.H., and C. Frenzen. (Convention date January 20th, 1910, Germany.) January 20th. (Complete.)

1,548. "Electrical and automatic control of engines, dynamos and batteries." L. Sunderland and G. C. Pillinger. (Addition to No. 29,944, 1909.) January 20th.

1,549. "Electrically-heated bed warmer and foot warmer." C. Kinzbrunner. January 20th.

1,562. "Sparking plug." Officine di Villar Perosa, Agnelli & Co. (Convention date June 25th, 1910, Italy.) January 20th. (Complete.)

1,563. "Electric welding." F. B. Koopman and Pontelec Welding Patents, Ltd. January 20th.

1,566. "Electric signalling on railways." H. Brown. January 20th.

1,573. "Apparatus for the electro-plating of crochet hooks and the like." H. Milward & Dons, Ltd., and J. Smith. January 21st.

1,580. "Pipe for the transmission of fluids, conduit for electric cables, and the like." J. T. Henthorne. January 21st.

1,609. "Electric furnaces." J. H. Reid. January 21st. (Complete.)

1,614. "Method of connecting electric wires to lampholders and the like." A. T. Crosher. January 21st. (Complete.)

1,619. "Process and arrangement in electromagnetic ore separators." January 21st. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1909.

Telephony and Telegraphy. S. G. Brown. 29,985. December 22nd.

Insulation of Condensers for Telephone Circuits. C. Cordes. 30,548. December 31st.

Electric Controllers, Starting Switches and the like. A. H. Curtis and Adams Manufacturing Co. 30,566. December 31st.

1910.

Electric Welding. E. B. Koopman. 71. January 1st.

Magnetic Devices for holding up Rivetting Tools and the like. S. Thomson. 81. January 1st.

Starting Switches for Electric Motors. W. R. Ansell. 205. January 4th.

Wireless Telephone Transmitter. A. A. Jahnke and S. C. Tate. 1,518. January 20th.

Device for Controlling the Relative Motion of Two Shafts Especially applicable for use with Electric Battery Regulating Switches. H. C. J. Fox, O. Lattin and Drake & Gorham, Ltd. 1,843. January 25th.

Telegraphic Relays. I. Kitsee. 2,348. January 31st.

Electric Braking. British Thomson-Houston Co. (General Electric Co.) 3,011. February 7th.

Electric Burglar Alarms. G. A. Aldrich. 3,527. February 14th.

Means for Electrically Lighting Gas Burners. M. Delage and D. Woog. 6,154. March 12th. (Date applied for under International Convention, March 11th, 1909.)

Electrical Sound-Producing Horns. H. Lucas and W. H. Edwards. 6,632. March 16th.

Magnetos for Ignition Purposes of Internal-Combustion Engines. J. Baker. 7 096. March 21st. (Cognate application, 18,278 of 1910.)

Dynamo-Electric Machines. Crompton & Co., J. Macfarlane and H. Burge. 7,488. March 26th.

Electric Train Control System. F. W. Prentice. 7,621. March 29th.

Method of Enclosing the Arc of Arc Lamps. Carbone Arc Lamp Syndicate. (J. W. Carbone.) 8,167. March 5th. (Application for Patent of Addition to 17,448 of 1909.)

Electrodes for Electric Arc Lamps. Geb. Siemens & Co. 9,076. April 14th. (Date applied for under International Convention, May 14th, 1909.)

Electric Induction Furnaces. J. H. Reid. 9,459. April 19th.

Electric Cables for Burglar and like Fire Alarm Systems. J. P. Williams. 11,667. May 11th.

Depolarising Agents for Electric Batteries. A. T. K. Estelle. 11 887. May 12th. (Date applied for under International Convention, May 18th, 1909.)

Electrical Switching Mechanism. D. Murray. 16,152. January 23rd.

Electric Resistance Controllers. Adams Manufacturing Co. (Cutler-Hammer Manufacturing Co.) 16,985. July 15th.

Magneto-Electric Machines. Firm Robert Bosch. 18,095. July 29th. (Date applied for under International Convention, October 15th, 1909.)

Synchronous Electric Motors. S. Dassenoy. 23,174. October 6th. (Date applied for under International Convention, October 6th, 1909.)

Manufacture of Electric Insulating Material. N. Peterson. 23,671. October 24th. (Date applied for under International Convention, October 20th, 1909.)

Tramway Festivities.—The employés of the Gateshead and District Tramways Co., and the Jarrow and District Electric Traction Co. met for their seventh annual tea, concert and dance on January 17th and 19th (half the staff each night) in the Parish Hall, Rawling Road, Gateshead. A substantial feast was provided, and a cordial vote of thanks was passed to the company for same. After tea the men were joined by their wives and friends for the concert and dance. The number of persons present on the first night was 250, and on the second 300. The men met at 6.30 p.m., and dispersed at 1 a.m. In the previous week the tramway employés' children had their annual tea and Christmas tree. Both of the entertainments were organised by the Sports Committee.

A German Enterprise in Italy.—After negotiations extending over some time the Commercial and Discount Bank of Berlin has disposed of a foreign electricity works. The undertaking is the electric supply works in the Italian town of Lecca, from which a tramway connection from Lecca to the coast town of Katalte is also worked. The electricity works involved an expenditure of £100,000 and were carried out by the Berlin firm of Arthur Koppel, who share in equal halves the ownership with the Berlin Bank. When the latter was absorbed by the Commercial and Discount Bank the half share in the Italian works was also taken over. The owners have, however, not had a very pleasant time with their property and are consequently glad to be relieved of it. It appears that the town of Lecca constantly remained indebted to the works for the light supplied, until the owners obtained authority by legal proceedings to stop the supply of light in case of the further refusal of the town to pay for it. The works have been carried on by the Berlin firm for the account of the Commercial and Discount Bank and have now been taken over by the town of Lecca at a price which practically corresponds with the original cost of establishment, amounting to £100,000. It may be assumed that as the undertaking has been transferred to the local authority the former owners have been more successful in securing the purchase price than they were in obtaining payment for the supply of light.

Concert.—To-morrow night, at 7.15 o'clock, at the Grand Hall, Bridge House Hotel, London Bridge, the tenth annual concert of the St. James' Electric Athletic Club is to be held.